Vol. XVI, No. 2 MARCH, 1946

THE TOOL ENGINEER

OFFICIAL PUBLICATION OF THE ASTE AMERICAN SOCIETY OF TOOL ENGINEERS

Great Undertakings ... by C. F. Briney

The A.S.T.E. New Era Exposition Opens Gate to Greater Industrial Progress ... by Doris B. Pratt

Diagnostic Chart for Management ... by The Pioneer Engineering Staff

The Tools and Techniques for the Production of Precision Gears—A Symposium—(Continued)

Facts about Gear Hobbing ... by The Barber-Colman Engineering Staff

Gear Lapping ... by Charles R. Staub

The Rights and Wrongs of Wage Incentive Plans ... by S. A. Cyrol

Calculation of Pin Measurement for Right and Oblique Cones ... by C. D. Wright

Tooling the Tools for Precision Manufacture of a Wobble Shaft ... by Harold Lundstrom

Tool Engineering—A Profession ... by O. W. Winter

Resistance Welding of Mild Steels ... by Wilson Scott

Departments

Fundamentals of Tool Engineering • Tools of Today • Industry • Colleges • South America • Questions and Answers • Around the Clock in Industry • Abstracts • Coming Events • Reading • A.S.T.E. News

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THE TOOL ENGINEER

AMERICAN SOCIETY OF TOOL ENGINEERS

Volume XVI **March, 1946** **Number 2**

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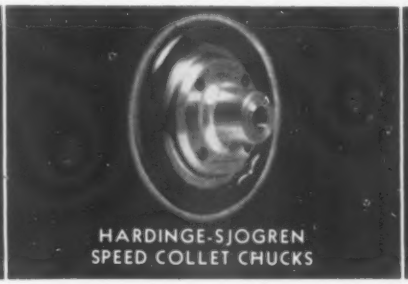

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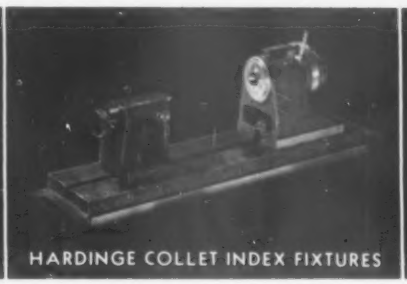

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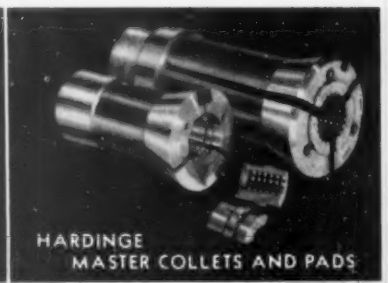

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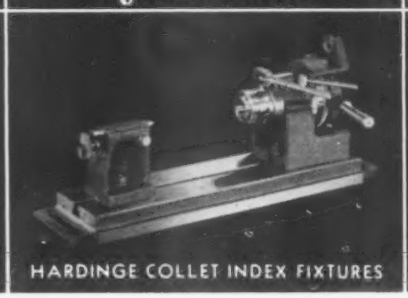

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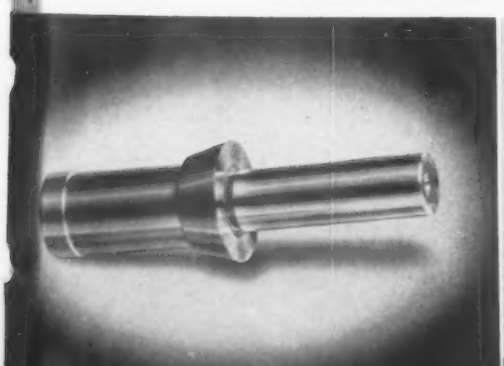

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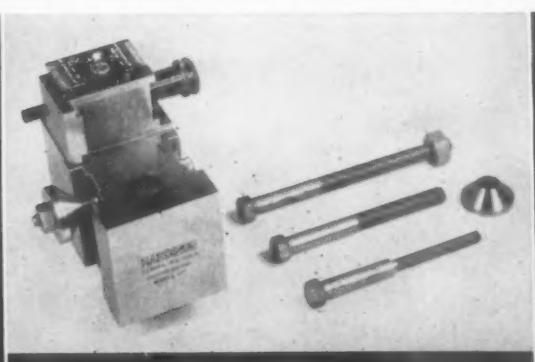

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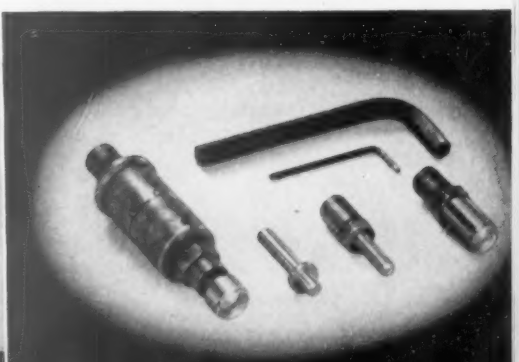

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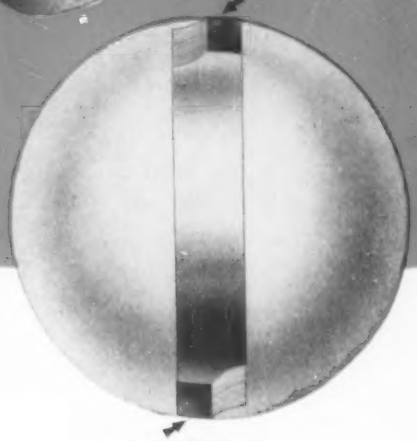
SINGLE END
Sizes 1.510" to 6.010"
(38 to 152 mm)

DOUBLE END
Sizes .240" to 1.510"
(6 to 38 mm)



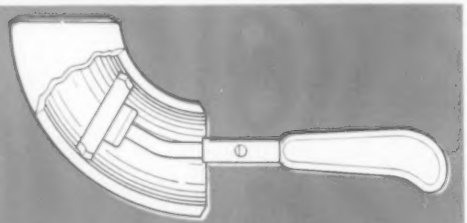
First

You can check plain, ordinary holes . . .

faster because the DuBo Gage is light, easy to enter (no pilot necessary).

better because you can check dimensional deviations such as taper and out-of-round.

GOES AROUND CORNERS



With the DuBo Gage you can even check around corners. Illustration shows a DuBo Gage with specially shaped shank for checking I.D. of an elbow at any point.

Taper enlarging away from the opening can be detected with DuBo Gage without removing part from the machine.

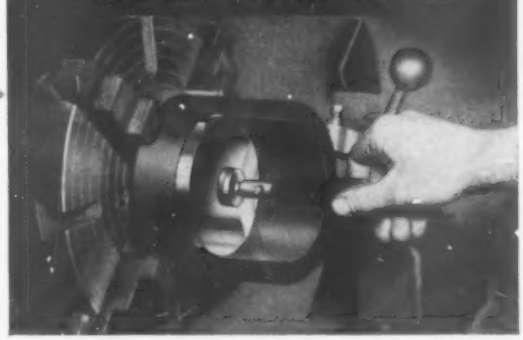
Write for Bulletin

*Patents Pending

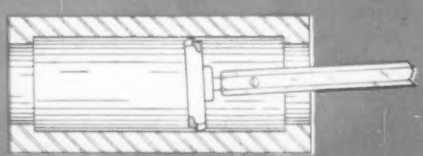
And

You can do other things with the DuBo Gage that you can't even begin to do with a cylindrical plug gage.

DETECTS BACK TAPER



GETS BY CONSTRICTIONS



Diameter of entrance of this bore is, by design, .005" to .008" less than central section which is to be checked. DuBo Gage can be entered through constricted opening, and larger diameter can be checked with ease.

Send us *your* bore checking problem for engineering review and recommendation.

See the DuBo Gage and other STANDARD GAGE developments at ASTE New Era Exposition

STANDARD GAGE CO., Inc., Poughkeepsie, N.Y.

HERE'S THE PRACTICAL *Solution* TO DIFFICULT TURNING OPERATIONS...

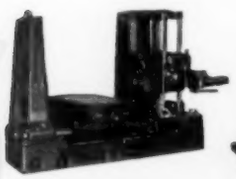
G. & L. Horizontal Boring Machines Equipped with Standard Attachments Offer the Simplest Overall Means of Machining Unwieldy Work

Hard-to-approach jobs such as these stub trunnion turning operations show how one class of difficult work is handled more easily and faster on Giddings & Lewis Horizontal Boring Machines. This is but a single example of the many practical machining possibilities open to the user of G. & L. equipment.

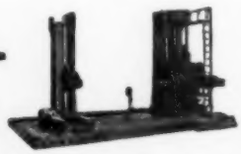
Continuous Feed Facing Heads accurately turn the trunnions on both the 33" diameter suction elbow and on the welded slide mechanism. *Dimensional tolerances and alignments are held to required specifications.* On no other type of equipment can such unwieldy, awkward pieces be machined with equal speed and facility.

Additional Machine Functions With or Without Standard Attachments

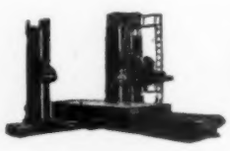
Extensive general-purpose milling, drilling, boring, threading, tapping and similar operations are easily performed on the standard G. & L. machine. Or, if the machine is equipped with suitable standard attachments or accessories, its work handling capacity may be increased. Inquire now of experienced Giddings & Lewis engineers how to use versatile and flexible G. & L. horizontal boring machines to your advantage. These men will be glad to offer practical and profitable suggestions for simplifying your general and specific machining problems.



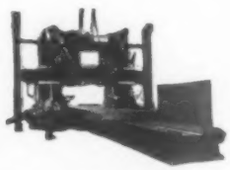
G. & L. Table Type Machine



G. & L. Floor Type Machine

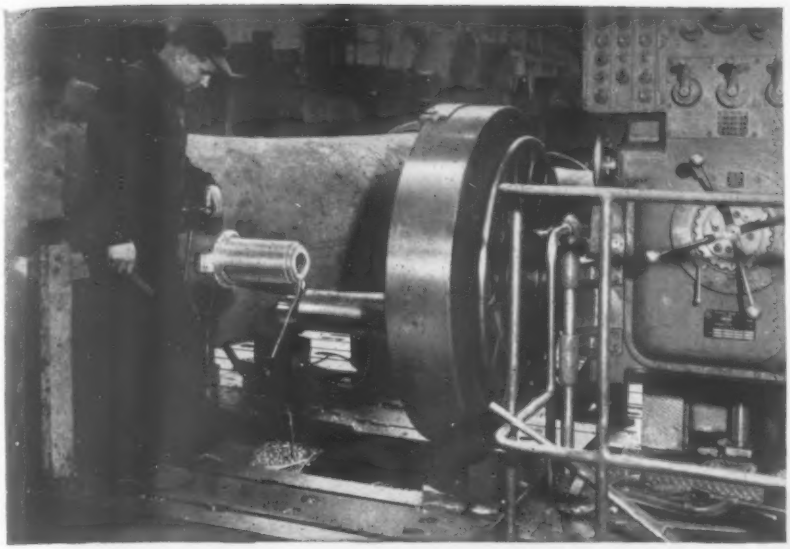


G. & L. Planer Type Machine

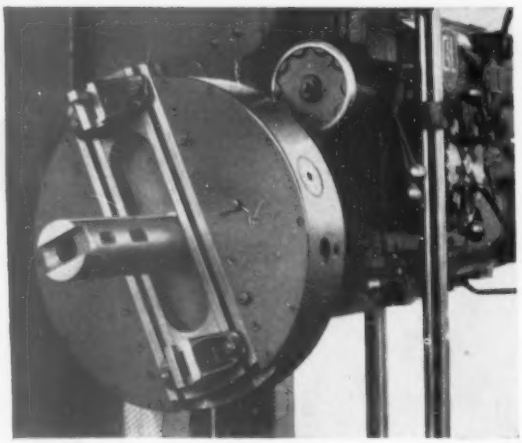


G. & L. Multiple Head Type Machine

GIDDINGS & LEWIS MACHINE TOOL CO.



Stub trunnion on a 33" diameter suction elbow being turned on a G. & L. floor type machine. Note the simple method of mounting the odd shaped workpiece and the use of the Continuous Feed Facing Head Attachment.

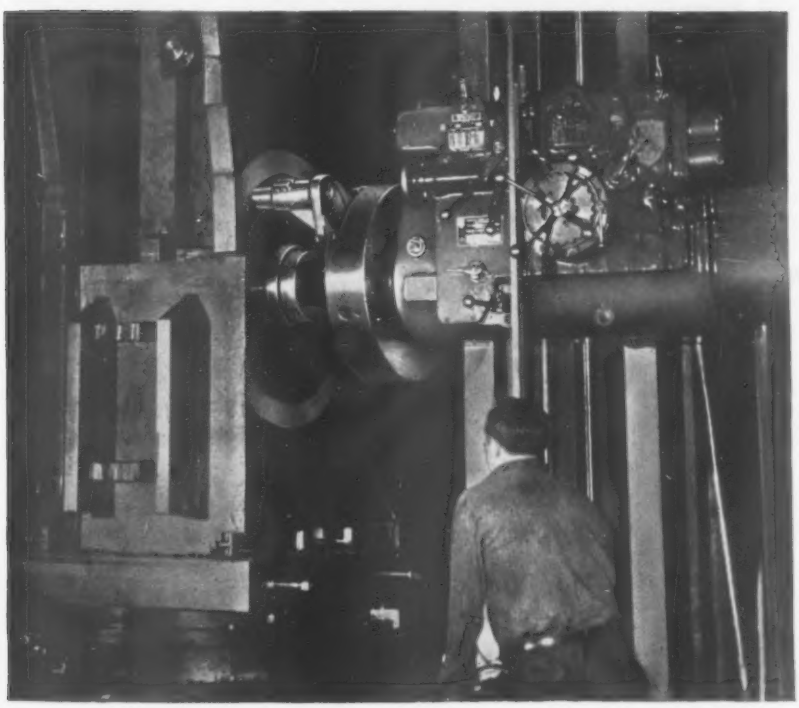


Standard Continuous Feed Facing Head Attachment for use on table, floor or planer type machines.

CONTINUOUS FEED FACING HEAD

This attachment is designed to simplify and speed the production of numerous difficult machining jobs. It is used for internal and external turning operations, for internal boring, grooving, recessing and threading. It is also used to perform a variety of rough and finish facing operations, and back facing operations when telescopic tools are employed. With this highly flexible attachment it is possible and practical to combine machining cuts, thus lowering production time. The working range of your Giddings & Lewis Horizontal Boring Machine is materially increased through its use.

Facing and turning operations performed on a G. & L. table type machine with a Continuous Feed Facing Head. Welded slide mechanism is mounted on a rotary table to facilitate indexing.



Note: Photographs through the courtesy of Danly Machine Specialties, Inc., Chicago, Illinois and Joshua Hendy Iron Works, Sunnyvale, California.

Valuable

FIELD PRODUCTION FACTS

will point the way to improved machining methods. Write today for your FREE file of actual case histories as presented in G. & L. Production Data Folder TE-36.

132 Doty Street • Fond du Lac, Wis.

Pease 88R . . .

A Brand New Pease

DRY DIRECT PROCESS MACHINE

Speed 30 **FEET PER MINUTE**

THE C. F. PEASE COMPANY

. . . A GREATER STEP FORWARD THAN THE FABULOUS SEVEN LEAGUE BOOTS EVER MADE

A Brand New PEASE *Continuous Machine*

FOR PRODUCING QUALITY WHITEPRINTS (DRY DIRECT PROCESS) ***IN CUT SHEETS OR ROLLS,*** AT HIGH SPEED AND AT LOW COST!

IN OVER 100 YEARS... since the invention of Blueprinting by Sir John Frederick William Herschel . . . there has never been a greater step forward in the development of tracing reproduction machines than the Pease "88-R". . . designed to produce quality Whiteprints (Dry Direct Process) at the highest practical rate of speed—30 feet per minute, the ability of the operator to feed the originals and paper into the printer is the only limiting factor. All you have to do is feed in the tracings and paper—cut sheet or rolls—virtually everything else is automatic . . . the finished prints are delivered in a matter of seconds.

14 Distinctive Features

- **Production Speed** (printing and developing) at speeds synchronized from 1 foof to 30 feet per minute.
- **Speed Control,** instantaneous and positive. A variable reactance controls the speed of our special A. C. variable speed motors. No complicated electronic apparatus to maintain.
- **Revolving or Sliding Contact,** a patented feature, is an outstanding improvement in cylinder printers combining the desirable features of both methods. A simple clutch lever allows the operator to instantly convert from the straight revolve to a sliding revolve in which the cylinder runs slightly faster than the tapes.
- **Maximum Printing Speed** is assured by the location of the 75 watt per inch High Pressure Mercury Tube inside the 8¼ inch diameter pyrex cylinder. An alzak reflector also serves as a variable light shutter for controlling the printing speed.
- **Cooling** the cylinder is accomplished by the same blower which forms the vacuum to convey the exposed prints to the developer. This method is original and permits maximum cooling without affecting tube efficiency.
- **Tracings Stacked** in receiving tray after falling easily and naturally onto the tape conveyor. Tracings are never confined to close quarters, sharp bends, etc., which injure the edges.
- **Convenient Foot Treadle** (Patent applied for) allows tracings and paper to be withdrawn easily and without damage, the action is positive.
- **Front or Rear Delivery** of finished prints is accomplished instantaneously by means of a lever located at the front of the machine.
- **Individual Control** of motors, high pressure mercury tube and developer units is provided by means of separate switches.
- **Selective Ammonia Feed,** either manual or automatic gives economy and complete control of ammonia consumption under all conditions of room temperature and material.
- **Exhaust System** is built in overhead and carries away the warm air from the printer as well as the developer fumes.
- **Operator Ease and Comfort** seated or standing means high production speeds and rapid feeding of all types of originals.
- **Long Life and Sturdy Construction,** are welded heavy structural steel framework—18 gauge sheet metal exterior—all parts exposed to ammonia fumes are stainless steel or aluminum—ball bearings sealed for life.
- **Safety is Assured** by fully enclosing the machine and following all necessary precautions. All dangerous moving parts and electrical circuits are behind locked doors which automatically break the high voltage circuit when opened.

SEE *Pease 88R* IN ACTUAL PRODUCTION • AMERICAN SOCIETY OF TOOL ENGINEERS NEW ERA EXPOSITION • CLEVELAND • BOOTH 1427
APRIL 8, 9, 10, 11, 12

Pease

2657 WEST IRVING PARK ROAD
CHICAGO 18 • ILLINOIS

STARRETT TOOLS

The Name That INDICATES

Standard for ACCURACY

The name "STARRETT" on the face of Dial Indicators is positive assurance of lasting satisfaction any way you look at them — design, workmanship, operating convenience, easy reading qualities — Starrett Dial Indicators measure up to your most critical standards. Ask your mill supply distributor to show you Starrett Dial Indicators and Starrett "LAST WORD" Indicators adapted to your requirements or write for Starrett Dial Indicator Catalog "E".

VISIT THE STARRETT EXHIBITION
BOOTHS 213-215
A.S.T.E. EXPOSITION, CLEVELAND

THE L. S. STARRETT CO. • ATHOL • MASSACHUSETTS • U. S. A.

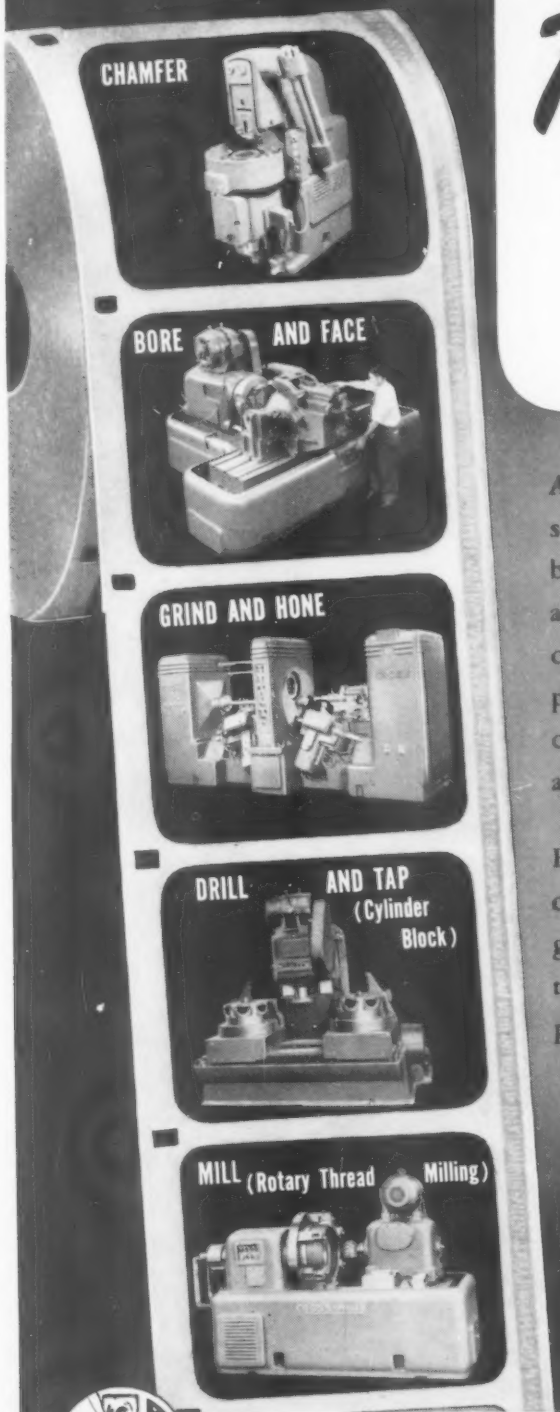
World's Greatest Toolmakers

STARRETT

PRECISION TOOLS • DIAL INDICATORS • GROUND FLAT STOCK
HACKSAWS • METAL CUTTING BANDSAWS • STEEL TAPES

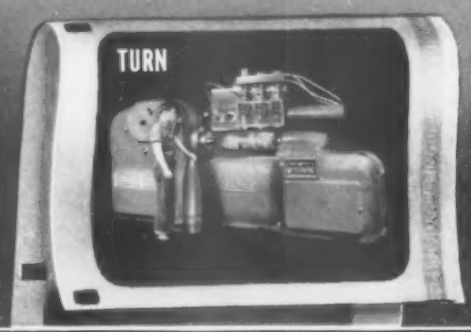
Tools for Profit

A New Motion Picture with Narration by LOWELL THOMAS



A new Cross motion picture, "Tools for Profit", shows the latest developments in machine tools built around the particular needs of a product. In addition to covering many different types of metal cutting, it also shows the various steps in the Cross procedure of designing and building special machines—giving a clear picture of the savings that are possible through their use.

Running time of this film is 35 minutes. You may obtain it free of charge for showing to company groups, engineering societies or other interested technical organizations. Write The Cross Company, Detroit 7, Mich., Dept. 214.



S-29

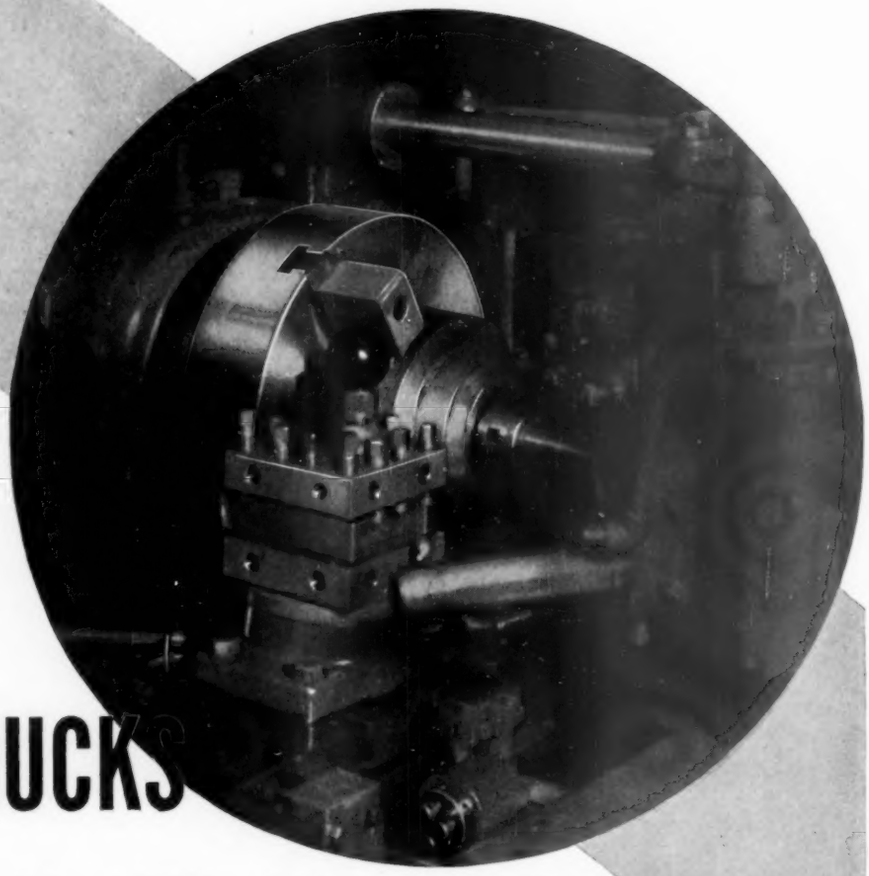
CROSS

ESTABLISHED 1888

SPECIAL MACHINES

TURNING · MILLING · DRILLING · BORING · REAMING · TAPPING · GRINDING

• POWER
• PRECISION
• SPEED



GOOD CHUCKS

ARE ESSENTIAL TO LOW COST PRODUCTION

POWER to take fast, heavy cuts...to turn a hot chip that makes the coolant smoke...

PRECISION that holds each one of a million work-pieces in exactly the same relation to the tool...and cuts down your percentage of rejects...

SPEED that gets a finished work-piece *out* of the chuck and a rough one *in*, in a matter of seconds...

These three factors are built into Cushman Chucks.

Before you decide on chuck equipment for those new machines, consult the Cushman engineers; they can provide special work-holding devices that will help you toward high accuracy, high volume production at low unit costs. Consult us on any work-holding problem.

THE CUSHMAN CHUCK CO.
HARTFORD 2, CONN.

A WORLD STANDARD FOR PRECISION

CUSHMAN
CHUCKS

For 300 to 1000% More Holes Per Tap!

What Are Electrolized Taps?

Electrolized Taps are taps of the finest precision workmanship treated by a remarkable new process that combines *high voltage with a chemical bath and a rare metal to produce a super-hard yet ductile surface on the cutting edges.*

What Can Electrolized Taps Do for You?

Electrolized Taps multiply tap life 3 to 10 times as a result of the extreme hardness of the case with which the cutting edges are fortified. Wear resistance is enormously increased. Chip and surface friction is reduced. Cleaner threads result.

The *electrolizing* treatment penetrates the tap so that tap life *after* sharpening as well as *before* sharpening is prolonged.

Electrolized Taps are distinguished by a *red* square atop the shank

What About Cost?

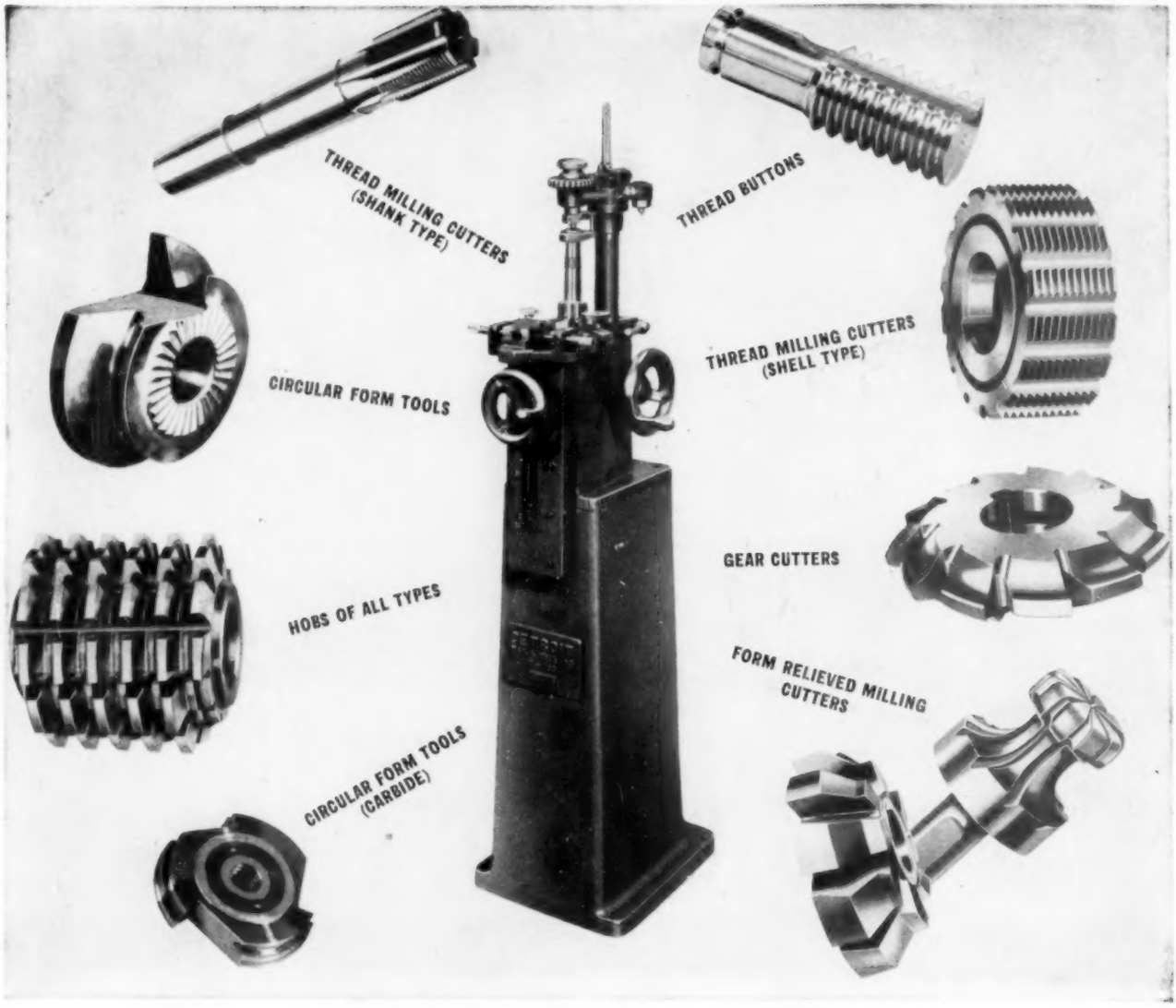
Electrolized Taps cost more than ordinary taps but *cost per tapped hole* is lower. Not only do you get more holes per tap but greater production per machine and per operator due to decreased "down time".

How Can You Get The "Proof of the Pudding?"

By asking your mill supply distributor to send you a trial lot of *Electrolized* Taps so that you may make a direct performance comparison with taps that have not been electrolized.

The increase in tap life is so great that you cannot afford to overlook this revolutionary advance in thread production and tap economy. For descriptive Bulletin, write

Electrolized TAP CORPORATION
148 WEST RIVER STREET
PROVIDENCE 1, RHODE ISLAND



You can check all these tools

ON A DETROIT HOOK CHECKER

Time consuming and cumbersome positioning of cutters and adjusting of equipment are eliminated on this "Detroit" Universal checker for all types of relieved form cutters. The result is faster and more accurate checking of hook or rake angle and of spacing of gashes or flutes after sharpening.

To check hook or rake all you do is slip the cutter between centers, bring the knife edge against the sharpened face by turning a micrometer until you can't see light between the two. Read the "Mike" The integral flute indexing head makes spacing checking just as simple.

For complete specifications and description of this remarkably simple and effective checker, ask for Bulletin HC-43.

GROUND TAPS & THREAD GAGES
•
TAP RECONDITIONERS

DETROIT
TAP & TOOL CO.
8432 BUTLER AVE. • DETROIT 11, MICHIGAN

•
SPECIAL THREADING TOOLS, MACHINES & CHECKERS
•

THREE QUINTALS ARE A CRUSHING LOAD!

Such penetrating observations as the one he made about tools moved readers to dub Thomas Carlyle the Sage of Chelsea. He observed: "Man is a Tool-using Animal. Weak in himself, and of small stature, he stands on a basis—of some half square foot, insecurely enough; has to straddle out his legs, lest the very wind supplant him. Feeblest of bipeds! Three quintals (336 pounds) are a crushing load for him; the steer in the meadow tosses him aloft like a waste rag.

"Nevertheless he can use tools, can devise tools. With these the granite mountain melts into light dust before him; the seas are his smooth highway; the winds and fire his unwearying steeds. Nowhere do you find him without tools; without tools he is nothing, with tools he is all".

May we add that the "man" at Vulcan can "devise tools" exceptionally well. With Vulcan tools you may be "all" in your line of endeavor.

The VULCAN TOOL Co.

730 LORAIN AVE.
DAYTON 10, OHIO

ENGINEERING PROCESSING DESIGNING BUILDING
TOOLS DIES JIGS GAUGES SPECIAL MACHINERY

WRITE FOR THIS

SPECIFY SUPER CARBIDE TIPPED REAMERS

. . . AND GET IMMEDIATE DELIVERY FROM STOCK!

Super reamers are supplied with hardened flutes —eliminating the possibility of them picking up chips and scratching finished surfaces. Shanks are tough rather than hard, so they will hold well in chuck or sleeve and present maximum resistance to breakage.

Specify "Super" and you are assured of Super Satisfaction.

★ **SOLID CHUCKING REAMERS.**
Stocked in both straight and Taper Shank, in sizes from ⅛" to 1½" diameter. Also stocked semi-finished for quick completion to special size or tolerance.

★ **JOBBERS TYPE REAMERS.**
Stocked in Taper Shank only in popular sizes from ¼" to 1½" diameter.

★ **EXPANSION REAMERS.**
Made with straight or Taper Shanks, stocked in all popular sizes from ½" to 1½" diameter.

★ **STUB SCREW MACHINE REAMERS.**
Stocked in semi-finished condition for quick completion to specified size from ¼" to ¾" diameter.

★ **SHELL REAMERS.**
Standard design. Not stocked. Supplied in all required sizes promptly.

WRITE TODAY FOR THIS LITERATURE

Descriptions, illustrations, prices and complete details of Super Carbide Tipped Tools for turning, facing, reaming, spot-facing, forming, grinder rests, wear parts, boring, drilling, grooving, counterboring, shaving, centers and special purposes are given in a series of folders. One or all of these folders will be sent to you upon request. Write today.

SUPER TOOL COMPANY

Carbide Tipped Tools

21650 Hoover Rd., Detroit 13, Mich. 4105 San Fernando Rd., Glendale 4, Cal.

« Great Undertakings »

THIS issue marks the start of our second year as publishers of our own TOOL ENGINEER, founded by the Society fourteen years ago.

In the past year you have seen your publication surge to a new high in technical and news value to the A.S.T.E. membership. You have also witnessed its enthusiastic endorsement and acceptance by the great tool engineering industries. The shrewdest advertising buyers in these industries have given us increasingly important schedules for TOOL ENGINEER advertising pages. This indicates their estimation of the value of our publication as a medium for reaching the men in the business who have the "know how" and the "say so," when it comes to buying and specifying production equipment and supplies.

Our future as owners and publishers of THE TOOL ENGINEER therefore seems brilliantly assured.

Another of our great undertakings is the A.S.T.E. Directory. This Directory, to be issued in 1946, will comprise listings and business biographies of our 18,000 members in the United States, Canada and other countries. It will be a Blue Book, not only of the men behind virtually every product that is manufactured and mass produced, but will contain vital information about the Society and its more than 70 chapters. Through the medium of this Directory, members and advertisers can gain quick and accurate basic information about every one of our members, and members in turn, will have a convenient buyer's guide.

Our third undertaking is in many ways the most important and spectacular activity of your present administration. This is the A.S.T.E. New Era Exposition to be held in Cleveland from April 8 to 12.

This is by far, a most important undertaking from the Society's standpoint, inasmuch as it will represent the first occasion which industry has had, since the war, to show the latest machines, methods and designs that are being made available to the tool engineer for the production and manufacture of post-war products.

At this writing, several hundred exhibitors have signed for exhibition space in Cleveland's huge public auditorium. A great percentage of these exhibits will represent working models. Every facility has been provided exhibitors to give them the best possible conditions under which to display, operate and describe the machine or processes featured.

The Program Committee is also planning a series of important meetings. Papers and technical data of great value to the progressive tool engineer will be presented. And, of course, the Society's annual meeting will take place in conjunction with the Exposition program.

Many of you—in keeping with the progressive and farseeing attitude of the tool engineer—have already made preparations to attend the Exposition. Those of you who have not done so should file your requests for hotel accommodations with National Headquarters immediately.

The A.S.T.E. New Era Exposition marks the beginning of a new era, not only in technical expositions for the Society, but a new era in thinking, growth and development of the American Society of Tool Engineers. The Society has come a long way since that handful of executives and tool engineers met in Detroit, some fourteen years ago, to lay the foundation of our great Society.

The A.S.T.E. and tool engineering have come of age. You can be sure that the future will show us great progress in our work and thinking, as it has in the past. And, don't forget!—your attendance at the A.S.T.E. New Era Exposition in Cleveland April 8 to 12 is an important step in that direction.

A.S.T.E. President, 1945-46

Cleveland Show and Convention

A.S.T.E. New Era Exposition Opens Gate

WHEN THE DOORS OF CLEVELAND PUBLIC Auditorium open April 8 on the fifth and largest Exposition sponsored by the American Society of Tool Engineers, key men, representing manufacturers in all parts of the nation and in other countries, will enter upon the threshold of a new industrial economy—an adventure in human advancement—elevating the living standards of millions who now lack essential comforts and conveniences.

Ultimate products of the machines, tools, methods and processes to be displayed and demonstrated will be labor-saving household appliances and equipment, better automobiles, cheap and speedy public transportation, opening new vistas in travel; ample, modern housing; and capital goods to rebuild war-torn communities abroad and to restore war-worn cities at home.

Out of man's ingenuity in creating death-dealing destruction have come astounding developments whose peacetime applications will engender happiness and more abundant living. New and heretofore secret techniques, achieved in beating plowshares into swords, will be revealed in the first major postwar Exposition of its kind.

Cost Saving to Be Theme

Dominant theme of the Exposition and the concurrent technical sessions will be how to produce better goods at lower cost despite higher wages. Typical of the cost and time-saving production methods and tools will be the exhibits of power-operated hand tools and the emphasis on cemented carbides.

Machines will run the gamut of mechanical and hydraulic presses, lathes, drill presses, tapping, milling, automatic and hand screw machines, gear hobbers, internal and surface grinders, hydraulic riveters and punches, resistance welding machinery, shapers, broaching, precision boring, centering, honing, and injection molding machines. Quality control will be stressed in faster and higher-precision checking devices, and electronically-operated gaging equipment.

The huge spectacle will include displays of chip disposal and materials handling equipment, air compressors, pumps, all-electric variable speed machine drives, heat treating furnaces, "white" blue printing apparatus, lubricants and coolants, jet drilling equipment, crush grinding devices, and new types of induction brazing and heating equipment.

Leading Companies Participate

The more than 250 companies participating in the mammoth show, whose names appear on subsequent pages, constitute a distinguished roster of industry. Admission to the Exposition is by invitation only. In addition to ASTE members, guests of exhibitors, and representatives of the press, students from recognized engineering schools will be admitted by pre-arrangement.

Seven afternoon and evening technical symposia will be conducted during the five days that the Exposition is in progress. The program opens Monday afternoon with a session on "Plant Layout and Materials Handling" as it affects and is affected by tool engineering. In the evening there will be a discussion of quality control not only as to dimensional tolerances but also as to physical characteristics, and the economics of quality from both standpoints.

"What the Tool Engineer Should Know About Cutting Fluids" will be explained Tuesday afternoon. A symposium on "New Techniques in Cutting Tools" is scheduled for that evening. The discussion will deal not only with cutters, but also with cutter materials and new techniques. "Tooling for Permanent Molds" on Wednesday afternoon will deal with the subject from the standpoint of the product involved, the tooling required, and uses of the processes.

The Thursday afternoon topic will be "Tool Engineering and Profits," a symposium on determining how to engineer

National Officers

These are your elected executive officers who have guided the affairs of the Society during the past year. Through their planning and efforts, many major projects have been undertaken. Among these are the largest postwar Exposition of its kind, the successful publication, under Society sponsorship, of The Tool Engineer, the "Tool Engineers' Handbook," and the ASTE Directory.

Each of these men has given unstintingly of his time and abilities to further the aims and purposes of the American Society of Tool Engineers—"an organized and functioning institution for the advancement of scientific knowledge in the field of Tool Engineering."

W. J. Frederick
Treasurer

W. A. Dawson
Asst. Sec'y-Treas.

A. M. Schmit
Secretary

A. M. Sargent
1st Vice-President

C. V. Briner
President

W. B. Peirce
2nd Vice-President

T. P. Orchard
3rd Vice-President

By Doris B. Pratt

To Greater Industrial Progress [ASTE]

production methods and equipment to produce a given number of parts at minimum cost.

Concluding session on Friday afternoon will be a study of "Controls and Drives for Special Machine Design," featuring hydraulic, electronic, and mechanical controls.

On Wednesday afternoon and evening well-known educators will present their views on higher learning in tool engineering. Speakers will include a representative from a highly-developed engineering organization in England. Details of these meetings appear on later pages of this issue.

Thursday evening, April 11, is reserved for the Society's Annual Dinner and installation of National Officers at Hotel Statler, official convention headquarters.

Plant Tours Scheduled

Twice a day there will be trips to interesting Cleveland plants where some of the equipment and processes shown at the Exposition and explained in the technical sessions may be seen in actual operation. The Society will furnish transportation for these tours.

Each morning, April 8 to 12 inclusive, three programs of technical films will be shown in separate theaters in the Public Auditorium.

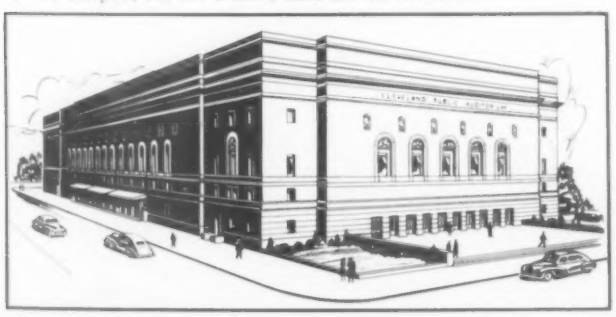
Facilities provided at the Auditorium include a lounge for exhibitors and guests, a first-class restaurant serving excellent meals at reasonable prices, and a cafeteria.

The Cleveland Show Committees will man an office for plant tour registration, sale of banquet tickets, and other services to visitors. Headquarters for the National Program Committee, which is conducting the Technical Sessions, also will be in this office.

Varied Services Provided

The National Public Relations Committee will operate a press room, and ASTE National Headquarters will staff a reception desk. The Cleveland Convention Bureau will furnish a competent crew to handle registration at the Auditorium, and the local Housing Bureau will maintain a service in all hotels, for those unable to secure accommodations.

Pre-convention events begin Friday morning, April 5, when the Resolutions Committee meets to screen the business to come before the Board of Directors on the two following days. I. F. Holland will again chairman this committee consisting of D. D. Burnside, R. B. Douglas, W. J. Gamble, K. C. Jasper, H. D. Jones, and H. R. Shearer.



Cleveland Public Auditorium, scene of the ASTE New Era Exposition, April 8-12, is one of the finest and largest in the United States. Its entire five and three-fourths acres of floor space will be required to adequately display the vast array of production material. Easily accessible, the municipal facility is within sight and walking distance of downtown hotels, transportation terminals and steamship docks.

The Handbook Committee also will confer Friday morning on the engineering manual being edited and published under their direction.

Saturday, April 6, will be an historic occasion when the first House of Delegates assembles to elect a Board of Directors from whom the present Board will choose National Officers for the ensuing year. Wednesday morning, April 10, the National Education Committee plans to meet to discuss their program.

While the full schedule of activities leaves little leisure time, many will take advantage of the opportunity to explore Cleveland, a city of culture and civic pride. Its miles of lake-front development, extensive park system and beautification program have made America's sixth city an attractive metropolis. Its colleges, stately art museum, and Severance Hall—home of the Cleveland Symphony—attract the intellectually-minded. The Stadium and Arena offer huge facilities for sports events.

Entertainment Diversified

Seven legitimate theaters present Thespian delights. Radio Stations WTAM, WGAR, WHK, and WCLE, where many important national broadcasts originate, welcome visitors and studio audiences. Good food is augmented with sophisticated entertainment in the leading hotels and night clubs. Restaurants, interesting in atmosphere and food specialties are numerous. High-class department stores, displaying fashionable merchandise, are a joy to shoppers. With such varied diversion, even the most blase will derive a fillip of pleasure from his stay in Cleveland during the ASTE New Era Exposition.

Further details of the ASTE New Era Exposition and National Membership Meeting are announced in the next eight pages and in the ASTE News section.

New Era *Exposition*

Condensed Program

Friday, April 5

9:00 A.M. Handbook Committee Meeting
Parlor M, Hotel Statler

9:30 A.M. Resolutions Committee Meeting
Tavern Room, Hotel Statler

Saturday, April 6

9:00 A.M. First Annual Meeting, House of Delegates
Parlor 345, Hotel Statler

1:00 P.M. Annual Meeting, Board of Directors
Parlor E, Hotel Statler

Sunday, April 7

9:30 A.M. Annual Meeting, Board of Directors
Parlor F-G-H, Hotel Statler

Monday, April 8

8:00 A.M. Registration, Public Auditorium

9:00 A.M. New Era Exposition Opens, Public Auditorium

9:30 A.M. Technical Motion Pictures
Ballroom and Parlors A and C

1:00 P.M. Plant Visits (To Be Announced)

2:00 P.M. Technical Session, Ballroom
"Plant Layout for Efficient Materials Handling"

6:00 P.M. New Era Exposition Closes

8:00 P.M. Technical Session, Ballroom
"Economic Control of Quality"

Tuesday, April 9

9:00 A.M. New Era Exposition Opens, Public Auditorium
Plant Visits (To Be Announced)

9:30 A.M. Technical Motion Pictures
Ballroom and Parlors A and C

1:00 P.M. Plant Visits (To Be Announced)

2:00 P.M. Technical Session, Ballroom
"Cutting Fluids"

6:00 P.M. New Era Exposition Closes

8:00 P.M. Technical Session, Ballroom
"New Techniques in Cutting Tools"

Wednesday, April 10

9:00 A.M. New Era Exposition Opens, Public Auditorium
Plant Visits (To Be Announced)

9:30 A.M. Technical Motion Pictures
Ballroom and Parlors A and C

10:00 A.M. National Education Committee Meeting
Tavern Room, Hotel Statler

1:00 P.M. Plant Visits (To Be Announced)

2:00 P.M. Technical Session, Parlor A
"Tooling for Permanent Molds"
Educational Session, Ballroom
"Tool Engineering Advancement"

6:00 P.M. New Era Exposition Closes

8:00 P.M. Educational Symposium, Ballroom
"Tool Engineering Education and Professional Development"

Thursday, April 11

9:00 A.M. New Era Exposition Opens, Public Auditorium
Plant Visits (To Be Announced)

9:30 A.M. Technical Motion Pictures
Ballroom and Parlors A and C

1:00 P.M. Visit to Aircraft Engine Research Laboratory
National Advisory Committee for Aeronautics

2:00 P.M. Technical Session, Ballroom
"Tool Engineering and Profits"

6:00 P.M. New Era Exposition Closes

7:30 P.M. Annual Dinner, Grand Ballroom, Hotel Statler
Speaker, George T. Christopher, President,
Packard Motor Car Co., Detroit, Mich.

Friday, April 12

9:00 A.M. New Era Exposition Opens, Public Auditorium
Plant Visits (To Be Announced)

9:30 A.M. Technical Motion Pictures
Ballroom and Parlors A and C

2:00 P.M. Technical Session, Ballroom
"Controls and Drives for Special Machine Design"

6:00 P.M. New Era Exposition Ends

April 8-12

Public Relations Committee and Press Room, *No. 1 East Office, Public Auditorium*
National Program Committee and Cleveland Show Committees, Plant Tour Registration and Banquet Tickets
No. 1 West Office, Public Auditorium

National Program Committee

O. W. Winter

F. J. Schmitt

E. V. Johnson

H. E. Linsley

W. B. McClellan

E. W. Baumgardner

H. D. Hall, Chairman

R. W. Ford

Stephen Urban

Technical Symposia

Monday, April 8

2:00 P.M. "Plant Layout for Efficient Materials Handling"

Chairman, W. B. McClellan, Detroit Chapter

"Plant Layout and Materials Handling"
Haylett B. Shaw, Staff Engineer
Methods Engineering Council
Midwestern Division Office, Kansas City, Mo.

"Mass Production Technique as Applied to Ammunition"
Otto F. Ewert, Vice President and General Manager, Ordnance Division, W. F. and John Barnes Co., Rockford, Ill.

8:00 P.M. "Economic Control of Quality"

Chairman, Stephen Urban, Syracuse Chapter

"Quality Standards and Specifications"
Edward S. Marks, Quality Engineer, Pratt & Whitney Aircraft, East Hartford, Conn.

"Fundamentals of Inspection Procedure"
Alfred L. Davis, Member of Staff, Rochester Institute of Technology, Rochester, N. Y.

"A New Approach—Statistical Quality Control"
Joseph G. Manuele, Director of Quality Control, Westinghouse Electric Corp., East Pittsburgh, Pa.

"Dimensional Control"
Paul V. Miller, Manager, Small Tool and Gage Div., Taft-Peirce Mfg. Co., Woonsocket, R. I.

Tuesday, April 9

2:00 P.M. "Cutting Fluids"

Chairman, F. J. Schmitt, Chicago Chapter

"The Testing of Cutting Fluids"
D. J. Wangelin, Research and Development Laboratories, The Pure Oil Co., Chicago, Ill.

"What the Tool Engineer Should Know About Cutting Fluids"
W. H. Oldacre, President and General Manager, D. A. Stuart Oil Co., Chicago, Ill.

Prepared Discussions by:
Joseph Geschelin, Chairman, Independent Research Committee on Cutting Fluids, Detroit, Mich.
Fred W. Lucht, Development Engineer, Carboloy Co., Inc., Detroit, Mich.
A. H. d'Arcambal, Vice President — Consulting Metallurgist, Small Tool and Gage Dept., Pratt & Whitney, Div. Niles-Bement-Pond Co., West Hartford, Conn.

8:00 P.M. "New Techniques in Cutting Tools"

Chairman, Robert W. Ford, Pittsburgh Chapter

"Manufacture of German Precision Cutting Tools and Gages During World War II"

"Germany in Defeat"
A. H. d'Arcambal, Vice President — Consulting Metallurgist, Small Tool and Gage Dept., Pratt & Whitney, Div. Niles-Bement-Pond Co., West Hartford, Conn.

"Exploring Carbide Possibilities in Single-Point Turning"
J. F. Allen, Project Engineer, The Warner & Swasey Co., Cleveland, Ohio

Wednesday, April 10

2:00 P.M. "Tooling for Permanent Molds"

Chairman, Earl V. Johnson, Dayton Chapter

"Permanent Molds for Rubber and Plastics"
Herman O. Poock, Asst. Master Mechanic, Inland Mfg. Div., G.M.C., Dayton Ohio

"Shape Turning on a Lathe for Molding Glass and Other Materials"
Kermit T. Kuck, Chief Engineer, The Monarch Machine Tool Co., Sidney, Ohio

2:00 P.M. "Tool Engineering Advancement"

Chairman, O. W. Winter, ASTE National Education Chairman

"Professional Accomplishments of the British Engineer"
E. W. Hancock, Section President, Institution of Production Engineers, London, England

8:00 P.M. "Tool Engineering Education and Professional Development"

Chairman, O. W. Winter, ASTE National Education Chairman

"The Five-Year Engineering Curricula at Ohio State University"
Charles E. MacQuigg, Dean and Director, College of Engineering, Ohio State University, Columbus, Ohio

"Research in Tool Engineering"
Prof. O. W. Boston, Chairman, Dept. of Metal Processing, College of Engineering, University of Michigan, Ann Arbor, Mich.

Thursday, April 11

2:00 P.M. "Tool Engineering and Profits"

Chairman, H. E. Linsley, Northern New Jersey Chapter

"Profit Producers for Industry"
A. G. Bryant, Vice President, Cleereman Machine Tool Co., Chicago, Ill.
Ralph E. Flanders, President, Bryant Chucking Grinder Co., Jones & Lamson Machine Co., Springfield, Vt.

"Relationship of Tool Engineering to Economics"
Clifford E. Ives, Owner, Ives Engineering and Planning Co., Chicago, Ill.

Friday, April 12

2:00 P.M. "Controls and Drives for Special Machine Design"

Chairman, E. W. Baumgardner, Cleveland Chapter

"Hydraulic Controls and Drives"
L. R. Twyman, Manager, Industrial Division, Vickers, Inc., Detroit, Mich.

"Mechanical Variable Speed Drives and Controls"
Lev A. Trofimov, Consulting Engineer, Cleveland, Ohio

"Electric and Electronic Drives and Controls"
G. A. Caldwell, Manager, Control Engineering, Westinghouse Electric Corp., East Pittsburgh, Pa.

"Drives and Controls on Standard Machines, and Special Adaptations"
B. P. Graves, Director of Design, Brown & Sharpe Mfg. Co., Providence, R. I.

Technical Speakers of Note...

PROMINENT FIGURES in engineering, educational, industrial, and business circles will participate in the five-day technical program, April 8-12.

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First session, "Plant Layout for Efficient Materials Handling," features: *H. B. Shaw*, Methods Eng'g Council. Early experience as an illuminating engineer preceded his present specialization . . . *O. F. Ewert*, W. F. & John Barnes Co., established and operated a wartime ammunition plant for his company. "Economic Control of Quality" will be explained by: *E. S. Marks*, Pratt & Whitney Aircraft, formerly connected with the Franklin Motor Car Co. . . . *A. L. Davis*, Rochester Institute of Technology, is President of the Rochester Quality Control Engineers . . . *J. G. Manuele*, Westinghouse Electric Corp., once abandoned a $75 a week job to continue at M.I.T. his self-taught high school education . . . *P. V. Miller*, Taft-Peirce Mfg. Co., received his B.S. from Iowa State College.

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Experts discussing "Cutting Fluids" are: *D. J. Wangelin*, The Pure Oil Co., who has done extensive work in cutting fluid testing . . . *W. H. Oldacre*, D. A. Stuart Oil Co., is active in a number of engineering societies . . . *Joseph Geschelin*, of the I.R.C. on Cutting Fluids, is a well-known speaker and editor . . . *F. W. Lucht*, Carboloy Co., majored in hydraulic machinery at University of Michigan . . . *A. H. d'Arcambal*, Pratt & Whitney, is a Past President of A.S.T.E.

Two authorities will reveal "New Techniques in Cutting Tools": *Mr. d'Arcambal*, who recently inspected German war plants, and *J. F. Allen*, Warner & Swasey Co., who has done research in mines and depth charges at Washington. Exponents on "Tooling for Permanent Molds" will be: *H. A. Poock*, Inland Mfg. Div., GMC, who joined his firm in 1930 as Chief Tool Designer . . . *K. T. Kuck*, Monarch Machine Tool Co., advanced to his present post after serving his company in various capacities. Addresses on "Tool Engineering Education" will be delivered by: *C. E. MacQuigg*, Ohio State University, who is also an Ordnance Reserve lieutenant colonel . . . *Prof. O. W. Boston*, University of Michigan, authors many technical papers and books . . . *E. W. Hancock*, Rubery-Owen & Co., Ltd., London, is a Section President of the Institution of Production Engineers, England.

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Heading up the "Tool Engineering and Profits" symposium are: *A. G. Bryant*, Cleereman Machine Tool Co., and officer of NMTBA . . . *R. E. Flanders*, Bryant Chucking Grinder Co., and Jones & Lamson Machine Co., has an extensive listing in "Who's Who" . . . *C. E. Ives*, Ives Eng'g and Planning Co., is an author, educator, and illustrator.

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Various phases of "Controls and Drives for Special Machine Design" are the topics of: *L. R. Twyman*, Vickers, Inc., an authority on the design and application engineering of hydraulic machinery . . . *L. A. Trofimov*, Consulting Eng., is a former Russian naval commander . . . *G. A. Caldwell*, Westinghouse Electric Corp., is experienced in the application of electrical equipment to metal working fields . . . *B. P. Graves*, Brown & Sharpe Mfg. Co., is a veteran with his company where he served his apprenticeship after graduating from the Rhode Island School of Design.

G. A. Caldwell

C. E. MacQuigg

A. G. Bryant

R. E. Flanders

J. G. Manuele

H. O. Poock

B. P. Graves

W. H. Oldacre

P. V. Miller

L. R. Twyman

L. A. Trofimov

K. T. Kuck

A. H. d'Arcambal

H. B. Shaw

A. L. Davis

O. W. Boston

J. F. Allen

D. J. Wangelin

Activities In Wide Variety . . .

Banquet

Eagerly anticipated by members everywhere, the Society's Annual Dinner, on the evening of April 11, is the one official social function on the convention program. Setting for the event will be the beautiful Grand Ballroom at Hotel Statler.

George T. Christopher, President, Packard Motor Car Co., Detroit, will be the guest speaker. His message will be one of national interest. Newly-elected National Officers will take the oath of office during the evening.

Surprise feature will be the annual award of the National Membership Trophy. Relatively limited accommodations make early reservations advisable. A ticket order form appears in the A.S.T.E. News section.

Plant Tours

Outstanding among inspection tours scheduled during the Exposition is a trip to the Aircraft Engine Research Laboratory of the National Advisory Committee for Aeronautics.

The Engine Research Building contains nearly 100 laboratories devoted to the study of all elements of aircraft power plants. The Altitude Wind Tunnel—only one of its kind anywhere—is capable of testing complete aircraft propulsion installations under precise altitude conditions up to 30,000 feet.

Unique, too, is the Icing Research Tunnel used to investigate flight characteristics of propeller power plants and aircraft components under icing conditions. Opportunity to visit these and the 7 other buildings comprising the huge government facility is an unusual one not to be overlooked.

Cleveland manufacturers who will show Exposition guests through their plants, and their respective products, include: Cleveland Graphite Bronze Co., aviation and automotive bearings and bushings; National Acme Co., automatic screw machines and tools; Reliance Electric and Engineering Co., variable speed controls; The Warner & Swasey Co., turret lathes, optical equipment, and farm machinery; Lincoln Electric Co., electric arc welders and welding equipment; Clark Controller Co., electrical controls for machinery; The Ohio Crankshaft Co., crankshafts for the automotive and aviation industries, and induction heating equipment; and the General Electric Glass Laboratories, Nela Park, where the latest technique in the production of electric lamps will be exhibited.

Citizenship identification will be required for admittance to some of the plants. Transportation will be provided by the Society. Registrations will be taken at the West Box Office in the Public Auditorium.

Technical Films

Throughout the five days of the Exposition, technical motion pictures will be projected in three theatres at the Public Auditorium, from 9:30 A.M. to 1:30 P.M.

Many of these productions, being furnished by Exposition exhibitors, will reveal services, products, and processes available to industry. Others will include sequences of interest to instructors in engineering schools and apprentice training classes.

A few will be entertaining and educational non-technical films showing industrial products in use. Daily showings will be scheduled in the Ballroom and Parlors A and C.

Host Chapter Committees

Local physical arrangements for the various convention activities are being handled by several committees of Cleveland Chapter members, working in conjunction with the National Program Committee. General Chairman is Joseph I. Karash, retiring Chairman of Cleveland Chapter. His committees will be responsible for details in connection with the banquet, technical sessions, housing, motion pictures, plant tours, reception, and signs.

J. I. Karash
General Chairman

H. E. Peiffer
Plant Tours

J. H. Schron
Signs

R. E. Harrold
Meeting Arrangements

William Reiff, Jr.
Accommodations

J. R. Fitzsimmons
Banquet

E. W. Baumgardner
Technical Films

Richard Miller
Reception

Civic-Minded Cleveland Offers

Ohio's Largest City to Be Springtime Host

Unusual feature at the ASTE Exposition will be the traveling Army Air Force Prisoner of War Exhibit. Display reproduces typical room which housed American airmen behind barbed wire in Germany. The exhibit includes collections of arts and crafts work, utensils, instruments, and tools to engineer escapes, constructed surreptitiously from materials at hand and improvised tools.

The show is under the direction of Lt. Col. Charles Ross Greening, one of the original Doolittle Tokio raiders, who conceived the idea of the exposition while a prisoner at Stalag Luft I.

Pratt & Whitney Photo

This measuring machine, which checks the pitch diameter of an A. P. I. gage over wires, is one of the new quality control devices to have its first public showing at the ASTE Exposition. Girls make good operators of this machine because of their bent for "good housekeeping," an essential in precision measuring.

A corner of the Grand Ballroom in Hotel Statler, showing the exquisite Wedgewood decor in the subtle blue with white, Etruscan cameo relief characteristic of the famous English potter.

Italian Renaissance architecture keynotes the entrance foyer into Cleveland Public Auditorium. Registrants at the ASTE New Era Exposition will enter from the left, pass through the doors at the right into the Arena. Stairs lead down to the main exhibition hall. Six exhibit halls and an arcade will be used to display hundreds of new products.

Nela Park—the 90-acre research, engineering, sales and executive headquarters of General Electric's Lamp Department. A visit to the Glass Laboratories is scheduled for ASTE Exposition guests.

Many Attractions to ASTE Guests

to Show and Convention Visitors, April 8-12

Cleveland Museum of Art in the Fine Arts Garden of Wade Park is famed for its collections of the arts of all countries and periods, and for its encouragement and development of art appreciation.

Severance Hall, palatial home of the Cleveland Symphony Orchestra, is the gift of John Long Severance. Located at University Circle, the building forms part of the city's cultural center.

Dominating the Cleveland skyline is the spire of Terminal Tower. From the 52nd floor observation platform, visitors may survey the entire city. In the foreground on Lake Erie is the U. S. Coast Guard Station.

By Ewing Galloway, N. Y.

Originally laid out by Moses Cleaveland, the city's founder, Public Square is today the hub of a great metropolis. View is from the Tower of Union Terminal used by most of the railroads entering Cleveland. Under the sidewalk kiosks are the street car loading platforms of Cleveland Railway. Public Auditorium, housing the ASTE Exposition, lies a block beyond the park visible at upper left.

Case School of Applied Science, with an enrollment of 750 engineering students, is recognized as one of the country's foremost technical schools. The Mechanical Engineering Building overlooks beautiful Wade Park.

New Era ASTE *Exposition*

Exhibitors

ACE ABRASIVE LABORATORIES
New York, N. Y.

ACE DRILL CO.
Detroit, Mich.

ACME TOOL CO.
New York, N. Y.

AERONAUTICAL PRODUCTS INC.
Washington Court House, Ohio

AGERSTRAND CORP.
Muskegon, Mich.

AIRCRAFT MACHINERY CO.
Burbank, Calif.

AIREON MFG. CO.
Kansas City, Mo.

AIR SPEED TOOL CO.
Los Angeles, Calif.

ALLEGHENY LUDLUM STEEL CORP.
Pittsburgh, Penna.

ALLIS-CHALMERS MFG. CO.
Milwaukee, Wis.

ALLISON CO.
Bridgeport, Conn.

AMERICAN ABRASIVE METALS CO.
Irvington, N. J.

AMERICAN CHAIN & CABLE CO., INC.
Bridgeport, Conn.

AMERICAN MAT CORP.
Toledo, Ohio

AMERICAN MEASURING INSTRUMENT CORP.
New York, N. Y.

AMERICAN SOCIETY FOR METALS
Cleveland, Ohio

AMERICAN SOCIETY OF TOOL ENGINEERS
Detroit, Mich.

B. C. AMES CO.
Waltham, Mass.

AMPCO METAL, INC.
Milwaukee, Wis.

ANCHOR COUPLING CO., INC.
Libertyville, Ill.

ANDERSON & SONS
Westfield, Mass.

ANKER-HOLTH MFG. CO.
Port Huron, Mich.

R. B. ANNIS CO.
Indianapolis, Ind.

ARMSTRONG BROS. TOOL CO.
Chicago, Ill.

ARO EQUIPMENT CORP.
Bryan, Ohio

ATLAS TOOL & DESIGNING CO.
Philadelphia, Penna.

BAILEY METER CO.
Cleveland, Ohio

W. O. BARNES CO., INC.
Detroit, Mich.

BARNES DRILL CO.
Rockford, Ill.

BARRETT-CRAVENS CO.
Chicago, Ill.

PATRICK BASSETT CO.
Royal Oak, Mich.

BAUSCH & LOMB OPTICAL CO.
Rochester, N. Y.

BAY STATE ABRASIVE PRODUCTS CO.
Westboro, Mass.

BEAVER TOOL & ENGINEERING CORP.
Royal Oak, Mich.

BEHR PRODUCTS CO.
Detroit, Mich.

BELL & GOSSETT CO.
Morton Grove, Ill.

THE BELL MACHINE CO.
Oshkosh, Wis.

THE BELLOWS CO.
Akron, Ohio

BENDIX-WESTINGHOUSE AUTOMOTIVE AIR BRAKE CO.
Elyria, Ohio

EDWARD BLAKE CO.
Newton Centre, Mass.

HENRY P. BOGGIS & CO.
Cleveland, Ohio

BOKUM TOOL CO., INC.
Detroit, Mich.

BOYAR-SCHULTZ CORP.
Chicago, Ill.

BOYD TOOL CO.
Royal Oak, Mich.

BRAMSON PUBLISHING CO.
Detroit, Mich.

BRIDGEPORT MACHINES, INC.
Bridgeport, Conn.

THE BRIGGS FILTRATION CO.
Bethesda, Md.

BRITISH INDUSTRIES SALES CORP.
New York, N. Y.

BROWN & SHARPE MFG. CO.
Providence, R. I.

CHARLES BRUNING CO., INC.
Chicago, Ill.

BUCKEYE TOOLS CORP.
Dayton, Ohio

BUFFALO MACHINERY CO., INC.
Buffalo, N. Y.

CADILLAC GAGE CO.
Detroit, Mich.

CARBOLOY CO., INC.
Detroit, Mich.

THE CARBORUNDUM CO.
Niagara Falls, N. Y.

W. R. CARNES CO.
Madison, Wis.

CHASE CHEMICAL CO.
Cleveland, Ohio

CHICAGO METAL HOSE CORP.
Maywood, Ill.

CHICAGO PNEUMATIC TOOL CO.
New York, N. Y.

CHICAGO SHOW PRINTING CO.
Chicago, Ill.

THE CINCINNATI TOOL CO.
Norwood, Cincinnati, Ohio

CIRCULAR TOOL CO.
Providence, R. I.

CLINTON MACHINE CO.
Clinton, Mich.

COLONIAL BROACH CO.
Detroit, Mich.

COMMANDER MFG. CO.
Chicago, Ill.

COMPAR INSTRUMENT CO.
Detroit, Mich.

CONE DRIVE DIV.
MICHIGAN TOOL CO.
Detroit, Mich.

COSA CORP.
New York, N. Y.

ARTHUR A. CRAFTS CO., INC.
Boston, Mass.

CRYSTAL LAKE GRINDING CO.
Crystal Lake, Ill.

THE CUSHMAN CHUCK CO.
Hartford, Conn.

N. J. DANIELS TOOL CO., INC.
Haverhill, Mass.

DAYTON ROGERS MFG. CO.
Minneapolis, Minn.

DELCO PRODUCTS DIV.
GENERAL MOTORS CORP.
Dayton, Ohio

THE DELTA MFG. CO.
Milwaukee, Wis.

DENNISON ENGINEERING CO.
Columbus, Ohio

A. P. DE SANNO & SON, INC.
Phoenixville, Penna.

DETROIT POWER SCREWDRIVER CO
Detroit, Mich.

DETROIT REAMER & TOOL CO.
Detroit, Mich.

DETROIT TAP & TOOL CO.
Detroit, Mich.

DETROIT UNIVERSAL DUPLICATOR CO.
Detroit, Mich.

DIAMOND MACHINE TOOL CO.
Los Angeles, Calif.

DIE CASTING MAGAZINE
Cleveland, Ohio

EUGENE DIETZGEN CO.
Chicago, Ill.

DOALL CO.
Minneapolis, Minn.

DOWNING ENGINEERING CO.
Dayton, Ohio

THE DUMORE CO.
Racine, Wis.

EAST SHORE MACHINE PRODS. CO.
Cleveland, Ohio

ECLIPSE COUNTERBORE CO.
Detroit, Mich.

ELECTRO-LIFT INC.
New York, N. Y.

ELGIN NATIONAL WATCH CO.
SAPPHIRE PRODUCTS DIV.
Elgin, Ill.

ENGIS EQUIPMENT CO.
Chicago, Ill.

EUTECTIC WELDING ALLOYS, INC.
New York, N. Y.

EVEREDE TOOL CO.
Chicago, Ill.

EX-CELL-O CORP.
Detroit, Mich.

FEDERAL PRODUCTS CORP.
Providence, R. I.

FONDA GAGE CO.
Stamford, Conn.

FORD MOTOR CO.
Dearborn, Mich.

THE FRICK-GALLAGHER MFG. CO.
Wellston, Ohio

DON GAGE CO.
Detroit, Mich.

GAGEMAKERS SUPPLY CO.
Pontiac, Mich.

THE GAIRING TOOL CO.
Centerline, Mich.

GAMMONS-HOAGLUND CO.
Manchester, Conn.

GARFIELD ENGINEERING CO.
Wichita, Kansas

GENERAL ELECTRIC CO.
Schenectady, N. Y.

GEPFERT MFG. CO.
DIV. BLACK DRILL CO.
Cleveland, Ohio

GEROTOR MAY CORP.
Logansport, Ind.

GIDDINGS & LEWIS MACHINE TOOL CO.
Fond du Lac, Wis.

GILLMAN ENGINEERING & MFG. CORP.
Janesville, Wis.

GODDARD & GODDARD CO.
Detroit, Mich.

GOVRO-NELSON CO.
Detroit, Mich.

V. L. GRAF CO.
Detroit, Mich.

GRAY CO., INC.
Minneapolis, Minn.

GRAY-MILLS CO.
Evanston, Ill.

GREENLEAF CORP.
Pittsburgh, Penna.

GRENBY MFG. CO.
Plainville, Conn.

GROB BROTHERS
Grafton, Wis.

E. F. HAGER & SON
Queens Village, L. I., N. Y.

HALL MFG. CO.
Toledo, Ohio

HANNA ENGINEERING WORKS
Chicago, Ill

HANNIFIN MFG. CO.
Chicago, Ill.

HARDINGE BROTHERS, INC.
Elmira, N. Y.

A. W. HECKER CO.
Cleveland, Ohio

THE HEIM CO.
Fairfield, Conn.

HELLER BROS. CO.
Newark, N. J.

HITCHCOCK PUBLISHING CO.
Chicago, Ill.

THE HOLO-KROME SCREW CORP.
Hartford, Conn.

HUEBNER PUBLICATIONS
TOOL & DIE JOURNAL
Cleveland, Ohio

C. B. HUNT & SON, INC.
Salem, Ohio

HYDRAULIC MACHINERY, INC.
Dearborn, Mich.

ILLINOIS TESTING LABORATORIES, INC.
Chicago, Ill.

ILLINOIS TOOL WORKS
Chicago, Ill.

INDEPENDENT PNEUMATIC TOOL CO.
Chicago, Ill.

THE INDUSTRIAL PRESS
New York, N. Y.

THE INGERSOLL MILLING MACHINE CO.
Rockford, Ill.

INGERSOLL-RAND CO.
New York, N. Y.

THE INTERNATIONAL NICKEL CO., INC.
New York, N. Y.

THE IRON AGE
New York, N. Y.

J. H. TOOL & MACHINE WORKS
Detroit, Mich.

JACK & HEINTZ, INC.
Cleveland, Ohio

JACOBS MFG. CO.
Hartford, Conn.

CHARLES L. JARVIS CO.
Middletown, Ohio

JERGENS TOOL SPECIALTY CO.
Cleveland, Ohio

JOHNSON GAGE CO.
Bloomfield, Conn.

JOHNSON GAS APPLIANCE CO.
Cedar Rapids, Iowa

JONES & LAMSON MACHINE CO.
Springfield, Vt.

KENNAMETAL, INC.
Latrobe, Penna.

KNU-VISE, INC.
Detroit, Mich.

KOEBEL DIAMOND TOOL CO.
Detroit, Mich.

KYLE-JOHNSON MACHINE CO.
Los Angeles, Calif.

LATROBE ELECTRIC STEEL CO.
Pittsburgh, Penna.

LAWSON-LESCHKE CO.
Royal Oak, Mich.

H. LEACH MACHINERY CO.
Providence, R. I.

LEMPCO CO.
Bedford, Ohio

LINCOLN ENGINEERING CO.
St. Louis, Mo.

LIPE-ROLLWAY CORP.
Syracuse, N. Y.

New Era ASTE *Exposition*

Exhibitors

JOHN E. LIVINGSTON CO
Detroit, Mich.

THE LLOYD GAGE & TOOL CO.
Cleveland, Ohio

LOGANSPORT MACHINES, INC.
Logansport, Ind.

THE LUFKIN RULE CO.
Saginaw, Mich.

LYON MACHINE CO.
Worcester, Mass.

McCASKEY REGISTER CO
Alliance, Ohio

McCROSKY TOOL CORP.
Meadville, Penna.

McGRAW-HILL PUBLICATIONS
AMERICAN MACHINIST
New York, N. Y.

THE McKINNEY TOOL & MFG. CO.
Cleveland, Ohio

MACKLIN CO.
Jackson, Mich.

MAGNAFLUX CORP.
Chicago, Ill.

MASTER SALES CO., INC.
Boston, Mass.

MASTERFORM TOOL CO.
Chicago, Ill.

F. A. MAXWELL CO.
Bedford, Ohio

M-B PRODUCTS CO.
Detroit, Mich.

MERIT MACHINE CO.
Northfield, Ohio

JULIUS MICHELSON
West Hartford, Conn.

MICHIGAN BROACH CO.
PRODUCT BROACH DIV.
Detroit, Mich.

MICHIGAN TOOL CO.
Detroit, Mich.

MICRO SWITCH DIV.
FIRST INDUSTRIAL CORP.
Freeport, Ill.

MICROMATIC HONE CORP.
Detroit, Mich.

MILL & FACTORY
Chicago, Ill.

MINIATURE TOOL CO.
Clawson, Mich.

MODERNAIR CORP.
Oakland, Calif.

MODERN MACHINE SHOP
GARDNER PUBLICATIONS, INC.
Cincinnati, Ohio

MONROE TOOL & MFG. CO.
Monroe, Mich.

MOORE PRODUCTS CO.
Philadelphia, Penna.

THE MOTCH & MERRYWEATHER
MACHINERY CO.
Cleveland, Ohio

MOTOR TOOL MFG. CO.
Detroit, Mich.

MUELLER ENGINEERING CO.
Detroit, Mich.

MUNTON MFG. CO.
Franklin Park, Ill.

NASH-ZEMPEL TOOLS
Milwaukee, Wis.

NATIONAL BROACH & MACHINE CO.
Detroit, Mich.

NICHOLS-MORRIS CORP.
New York, N. Y.

NICHOLSON FILE CO.
Providence, R. I.

NOBLE & STANTON
Bedford, Ohio

NORTON CO.
Worcester, Mass.

THE O. K. TOOL CO.
Shelton, Conn.

O'NEIL-IRWIN MFG. CO.
Minneapolis, Minn.

OWATONNA TOOL CO.
Owatonna, Minn.

PARKER-KALON CORP.
New York, N. Y.

THE C. F. PEASE CO.
Chicago, Ill.

PEERLESS GAUGE CO.
Detroit, Mich.

PENTON PUBLISHING CO.
STEEL
Cleveland, Ohio

PHYSICISTS RESEARCH CO.
Ann Arbor, Mich.

PIONEER ENGINEERING & MFG. CO.
Detroit, Mich.

PIONEER PUMP & MFG. CO.
Detroit, Mich.

PIPE MACHINERY CO.
Cleveland, Ohio

POLLAK MFG. CO.
Arlington, N. J.

PORTER-CABLE MACHINE CO.
Syracuse, N. Y.

PORTMAN MACHINE TOOL CO.
New Rochelle, N. Y.

PRATT & WHITNEY
KELLERFLEX DIV.
DIV. NILES-BEMENT-POND CO.
West Hartford, Conn.

PRECISE PRODUCTS CO.
Racine, Wis.

PRECISION SERVICE CORP.
Cleveland, Ohio

PRISONER OF WAR DISPLAY
U. S. WAR DEPARTMENT
Washington, D. C.

PRODUCTO MACHINE CO.
Detroit, Mich.

PUTNAM TOOL CO.
Detroit, Mich.

RACINE TOOL & MACHINE CO.
Racine, Wis

RACK ENGINEERING CO.
Detroit Mich.

REDMER AIR DEVICES CORP.
Chicago, Ill.

RELIANCE ELECTRIC & ENGINEERING
CO.
Cleveland, Ohio

REPUBLIC DRILL & TOOL CO.
Chicago, Ill.

REPUBLIC GAGE CO.
Detroit, Mich.

ROBOTOOLS, INC.
Dexter, Mich.

ROCKFORD MAGNETIC PRODUCTS
CO.
Rockford, Ill.

ROSS OPERATING VALVE CO.
Detroit, Mich.

H. C. ROUSHKOLB ENGINEERING CO.
Detroit, Mich.

ROYAL OAK TOOL & MACHINE CO.
Royal Oak, Mich.

RUSTLESS IRON & STEEL DIV.
THE AMERICAN ROLLING MILL CO.
Baltimore, Md.

SAGINAW BEARING CO.
Saginaw, Mich.

SALES SERVICE MACHINE TOOL CO.
St. Paul, Minn.

SAV-WAY INDUSTRIES
Detroit, Mich.

SCHAUER MACHINE CO.
Cincinnati, Ohio

A. SCHRADER'S SON
DIV. SCOVILL MFG. CO., INC.
Brooklyn, N. Y.

SEVERANCE TOOL INDUSTRIES, INC.
Saginaw, Mich.

THE SHEFFIELD CORP.
Dayton, Ohio

SHELDON MACHINE CO., INC.
Chicago, Ill.

SHELL OIL CO., INC.
New York, N. Y.

SIMONDS ABRASIVE CO.
Philadelphia, Penna.

SIMONDS SAW & STEEL CO.
Fitchburg, Mass.

SIMONDS WORDEN WHITE CO.
Dayton, Ohio

SIZE CONTROL CO.
Chicago, Ill.

SKILSAW, INC.
Chicago, Ill.

THE SKINNER CHUCK CO.
New Britain, Conn.

SNYDER TOOL & ENGINEERING CO.
Detroit, Mich.

SOCONY-VACUUM OIL CO., INC.
New York, N. Y.

SOMMER & ADAMS CO.
Cleveland, Ohio

SOUTH BEND LATHE WORKS
South Bend, Ind.

SPECIAL ENGINEERING SERVICES,
INC.
Detroit, Mich.

STANDARD GAGE CO.
Poughkeepsie, N. Y.

STANDARD PRESSED STEEL CO.
Jenkintown, Penna.

STANDARD SHOP EQUIPMENT CO.
Philadelphia, Penna.

STAPLES TOOL & ENGINEERING CO.
Cincinnati, Ohio

STAR MACHINE & TOOL CO.
Cleveland, Ohio

THE L. S. STARRETT CO.
Athol, Mass.

STATE MFG. & CONSTRUCTION CO.
Franklin, Ohio

STEEL CITY TESTING LABORATORY
Detroit, Mich.

STEEL PRODUCTS ENGINEERING CO.
COMBUSTION AIR DIV.
Springfield, Ohio

STEINLE MACHINE CO.
Hartford, Conn.

THE STITES TOOL CO.
Cleveland, Ohio

STOKERUNIT CORP.
Milwaukee, Wis.

H. E. STONE SUPPLY CO.
Oaklyn, N. J.

HERMAN STONE CO.
Dayton, Ohio

STRONG-CARLISLE & HAMMOND CO.
MAC-IT PRODUCTS DIV.
Cleveland, Ohio

D. A. STUART OIL CO., LTD.
Chicago, Ill.

SUNNEN PRODUCTS CO.
St. Louis, Mo.

SUN TOOL & GAGE CORP.
New York, N. Y.

SUPERDRAULIC CORP.
Dearborn, Mich.

SUPER TOOL CO.
Detroit, Mich.

SUTTON TOOL CO.
Sturgis, Mich.

SWARTZ TOOL PRODUCTS CO., INC.
Detroit, Mich.

SWEDISH GAGE CO. OF AMERICA
Detroit, Mich.

THE TAFT-PEIRCE MFG. CO.
Woonsocket, R. I.

G. H. TENNANT CO.
Minneapolis, Minn.

TINNERMAN PRODUCTS, INC.
Cleveland, Ohio

THE TOOL ENGINEER
TOOL ENGINEERS' HANDBOOK
AMERICAN SOCIETY OF TOOL
ENGINEERS
Detroit, Mich.

TORIT MFG. CO.
St. Paul, Minn.

TRABON ENGINEERING CORP.
Cleveland, Ohio

TRIPLEX MACHINE TOOL CORP.
New York, N. Y.

TUBULAR MICROMETER CO.
St. James, Minn.

TUNGSTEN CARBIDE TOOL CO.
DIV. MICHIGAN TOOL CO.
Detroit, Mich.

TURCHAN FOLLOWER MACHINE CO.
Detroit, Mich.

ULTRA-LAP MACHINE CO.
Detroit, Mich.

UNION CARBIDE & CARBON CORP.
HAYNES STELLITE CO.
New York, N. Y.

UNITED PRECISION PRODUCTS CO.
Chicago, Ill.

U. S. NAVY
BUREAU OF SHIPS
Washington, D. C.

UNIVERSAL ENGRAVING & COLOR
PLATE CO.
ENGINEERING SPECIALTIES DIV.
Cleveland, Ohio

VAPOR BLAST MFG. CO.
Milwaukee, Wis.

VASCOLOY-RAMET CORP.
Detroit, Mich.

VICKERS, INC.
Detroit, Mich.

VINCO CORP.
Detroit, Mich.

VISI-TROL CORP.
Detroit, Mich.

WALES-STRIPPIT CORP.
No. Tonawanda, N. Y.

WALKER-TURNER CO., INC.
Plainfield, N. J.

WARDWELL MFG. CO.
Cleveland, Ohio

WEBSTER PRODUCTS CO.
Cleveland, Ohio

WELDON TOOL CO.
Cleveland, Ohio

WELLS MFG. CORP.
Three Rivers, Mich.

WENDT-SONIS CO.
Hannibal, Mo.

WESSON CO.
Ferndale, Mich.

WETMORE REAMER CO.
Milwaukee, Wis.

WICKMAN CORP.
Detroit, Mich.

J. H. WILLIAMS & CO.
New York, N. Y.

WILLEY'S CARBIDE TOOL CO.
Detroit, Mich.

WILSON MECHANICAL INSTRUMENT
CO., INC.
New York, N. Y

N. A. WOODWORTH CO.
Detroit, Mich.

ZAGAR TOOL, INC.
Cleveland, Ohio

W. M. ZIEGLER TOOL CO.
Detroit, Mich.

By The Pioneer Engineering Staff

Diagnostic Chart for Management

In which a pattern is laid down, equally applicable to small and large plants, for the complete coordination and maximum efficiency of industrial organizations

If a man feels himself not quite "up to snuff," a good doctor can diagnose the trouble because he knows how each organ of the body *should* function, and the symptoms which indicate misbehavior. An entire industrial organization can also find itself operating with less than desirable efficiency, and it is to aid in the diagnosis of organizational mal-adjustment that this treatise has been prepared.

We have shown, as briefly and clearly as possible, the normal functions of each division of a typical manufacturing business, the proper coordination between departments, and the points of danger to be looked for in the operation of each.

A large corporation, viewed department by department, is an appallingly intricate thing; yet viewed as a whole, it is fundamentally the same as a small organization or, in fact, as an individual engaged in operating a one-man enterprise. The difference is in volume only.

When an individual, conducting a small business, discovers that the volume of business is beyond his capacity to handle, he hires a helper, or two helpers, or ten, or two hundred thousand; yet not one single *fundamental function* has been added.

COMPARISON

An Individual

1. Decides what product he is going to make, and determines his plan of operation (policy).
2. Designs his product and decides on material to be used.
3. Determines what tools and equipment he needs.
4. Sets up his shop, installs necessary lights, power and other facilities, provides space for getting material in, storing it, and a convenient place for sending the finished product out, and arranges a convenient layout for his equipment.
5. Buys equipment. Figures amount of material he has to buy, orders it, receives it and stores it after inspecting to see if it is what he ordered.
6. Makes some sales.
7. Builds products to fill orders.
8. Estimates number of future orders he may expect.
9. Sends products to customers.
10. Sends bills to customers and pays his own.
11. Figures ways and means for improving product and talks over problems with customers.
12. Hires a helper and explains duties.
13. Figures out what it cost him to build product and amount of profit on the operation. Sets aside fund to continue and expand.
14. Orders additional material and tells vendors when he wants it delivered.
15. Pays his helper and outlines to him the amount of work to be turned out in the immediate future. Explains how he can turn out better work faster.
16. Writes and sends out letters to prospective buyers.
17. Calls on customer who has advised of difficulty with product. Repairs or adjusts trouble.
18. Figures out cause of trouble and makes changes to avoid repetition in future.

A Group of Individuals
(*Stockholders of a Corporation*)

1. Board of Directors
   a) General Manager
2. Chief Engineer
3. Production Engineer (Master Mechanic)
4. Factory Manager
   a) Plant Engineer
   b) Production Engineer (Master Mechanic)
   c) Production Manager
5. Purchasing Agent
   a) Receiving Dept.
   b) Quality Manager
   c) Stores
6. Sales Manager
7. Production Manager
8. Sales Manager (Market Analysis)
9. Shipping Dept.
10. Comptroller
    a) Accounting Dept.
11. Engineering Research
    a) Sales Research (Customer demand)
12. Personnel Manager
13. Comptroller
    a) Cost Dept.
    b) Budget Manager
    c) Finance Director
    d) Treasurer
14. Production Manager
    a) Purchasing Agent
    b) Materials Control Manager
15. Time Keeper
    a) Pay Master
    b) Production Manager
    c) Time and Motion Study
16. Advertising
17. Service Manager
    a) Engineer
18. Chief Engineer
    a) Experimental and Research Manager
    b) Quality Manager

The purpose of any business enterprise, large or small, is to make a profit. In order to accomplish this purpose and continue in business, it must sell, produce, and deliver the best possible quality at the lowest possible price.

Since an individual has all the collateral facts concerning his business within himself, it is comparatively easy for him to make decisions. Not so a larger organization, unless each department performs its functions well and in close coordination with other departments. Otherwise, overlapping of duties and duplication of efforts, responsibilities and records inevitably develop, leading to discord and inefficiency.

A. M. Sargent **is president of the Pioneer Eng'g & Mfg. Co., and of the Pioneer Pump & Mfg. Co. A charter member of the A.S.T.E. and the Society's first Nat'l Sec'y, he has served as a Director and, currently as 1st Vice President. *The Diagnostic Chart for Management*, of which this article is a summary, represents several years work on the part of picked management experts working under Mr. Sargent's direction.**

Top management should regard the organization as a symphony of effort, lending no undue importance or prestige to any one department. Department heads should realize that their individual groups are of importance or value only in proportion to the degree with which they coordinate their efforts with other departments.

We make no attempt to specify details, as these must be worked out to fit individual situations, just as, in case of smaller organizations, the various departmental functions set forth may be combined in one small group or in one individual.

ENGINEERING DEPARTMENT (Chief Engineer)
(*Responsible to General Manager*)

FUNCTIONS:

1. Design the finished product and its component parts.
2. Issue Bills of Material or Specifications.
3. Specify materials to be used.
4. Conduct experiments and tests.

SUBDIVISIONS & DETAILS

DESIGN & MATERIAL SPECIFICATIONS:

1. Design the finished product and its component parts. Specify material and assign numbers and names to all parts.
2. Issue Bills of Material or Specifications, showing part number, name and quantity of each per finished unit.
3. Standardize design and size of parts and material as much as possible in order to facilitate production and reduce costs of material, machinery, tools, inventory and service.
4. Make Engineering changes when necessary or advisable, and issue drawings and notifications to cover.

ENGINEERING RECORDS VAULTS:

1. Make reproductions of tracings, Bills of Material or Specifications, and Engineering change notifications.
2. Furnish all or any one of them to Factory Manager, Quality Manager, Purchasing Dept., and Accounting Dept., or to their subdivisions as requested.
3. Maintain files of all tracings, blueprints and reproductions as required, also pertinent catalogs, price lists and circulars from outside organizations.

EXPERIMENTAL & RESEARCH:

1. Conduct research for better methods, materials and design.
2. Analyze and anticipate trend of competitive market—competitors' products and policies.
3. Either supervise or actively assist in servicing or repairing product.
4. Review service requirements and consumer complaints in order to spot and remedy weaknesses.

METALLURGICAL AND TESTING LABORATORIES:

1. Check and analyze samples of parts and materials to discover characteristics or ascertain if they meet Engineering specifications; report findings.

MATERIALS REVIEW:

1. Recheck materials rejected by the Inspection Dept. in an effort to salvage as much as possible.
2. Issue instructions as to whether materials should be scrapped, reworked, or used, and send materials for reworking to Salvage or Repair Dept., as these materials should never go back through the production line.

COORDINATION

1. With Sales Dept. and Quality Manager, in conducting adequate market research.
2. With Sales Dept., Quality Manager, Accounting Dept., Purchasing Dept., and, through the Factory Manager, with Production Manager and Master Mechanic in order to (a) determine if customer requirements are economically sound, (b) keep costs within bounds, (c) establish prices.
3. With Sales Dept., Service Dept., and Quality Manager in order to correct defects and improve product.
4. With Quality Manager in reviewing materials.
5. With Purchasing Dept., Quality Manager and Sales Dept., in checking and testing characteristics or specifications of materials.

POINTS OF DANGER

1. Lack of coordination with other departments.
2. Faulty design.
3. Improper or uneconomical specifications.
4. Insufficient experiment and test.
5. Unnecessary Engineering changes.
6. Lack of standardization.
7. Carelessness in determining whether ideas or requests from customers and Sales Dept. are economically sound.
8. Inadequate service.

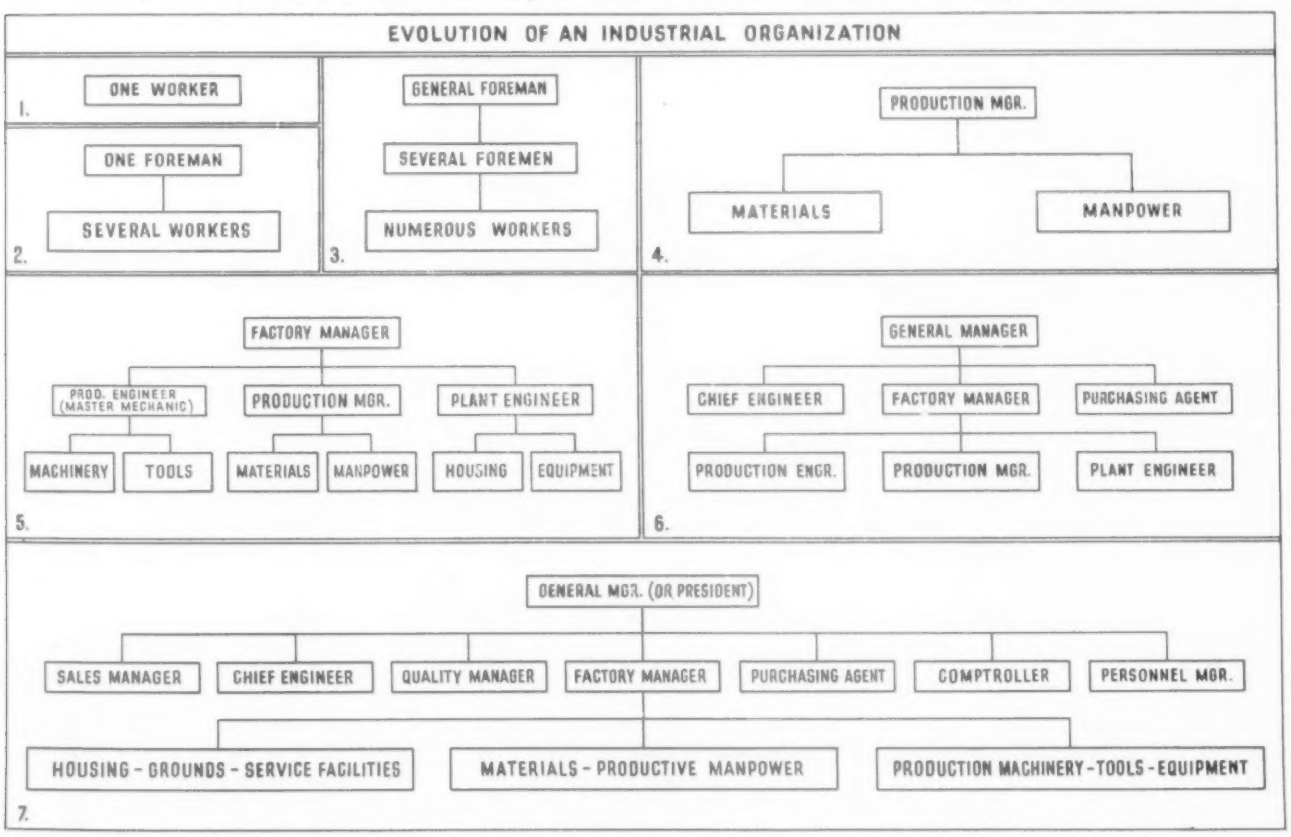
SALES DEPARTMENT (Sales Manager)

(Responsible to General Manager)

FUNCTIONS:

1. Obtain orders for the product.
2. Quote prices, make commitments as to delivery, quality and quantity.
3. Advertise product.
4. Train salesmen.

The chart, below, shows the evolution of an industrial enterprise from a one-man shop to a corporation employing many workers and executives.



5. Establish distributors and dealers.

6. Survey and analyze market, conduct research as to consumer's requirements, competitive products, policies and trends, forecast sales.

NOTE: Item No. 5 depends on type of product (See Service note).

SUBDIVISIONS AND DETAILS

ADVERTISING:

1. Make analysis of market potentials.

2. Decide type of advertising best suited to reach the greatest number of prospective buyers in the most effective manner.

3. Retain reputable Advertising Agency if desirable.

4. Synchronize all advertising with sales plans.

SALES PROMOTION:

1. Plan, design and distribute direct sales aids to distributors and dealers; must tie in with overall sales and advertising plans.

2. Train salesmen.

3. Compile and issue Catalogs, Discount Schedules, Price Lists.

SALES ACCOUNTING:

1. Keep record of all sales, quotations, or customer commitments.

2. Estimate sales expenses, compile budgets, record expense accounts, audit all sales, advertising and promotion bills.

3. Issue sales reports, showing comparison with previous corresponding periods.

SERVICE:

1. See that all distributors and dealers have adequate facilities to handle repair and maintenance service in their districts.

2. Train field representatives and instructors.

3. Plan and conduct service sales campaign in strict coordination with sales, advertising and sales promotion plans.

4. Compile and issue service reports, showing type of service performed, parts used, and expenses involved or profit made, and comparison with previous corresponding periods.

5. Record and report customer complaints if they represent a serious or general situation.

NOTE: The above service set up is pertinent only to products which are sold through dealer organizations direct to the ultimate consumer, such as automobiles, household appliances, furnaces, etc. For some types of products, such as highly technical equipment, precision machinery, machine tools, etc., coordination between Sales and Engineering must be so close that they may be grouped as one department.

COORDINATION

1. With Engineering (Experimental & Research) Dept. and Quality Mgr. on customer requirement and market analysis.

2. With Engineering Dept., Factory Manager, Quality Manager, Accounting Dept. and Purchasing Dept. before making commitments as to design, price, delivery, schedule, quality or quantity.

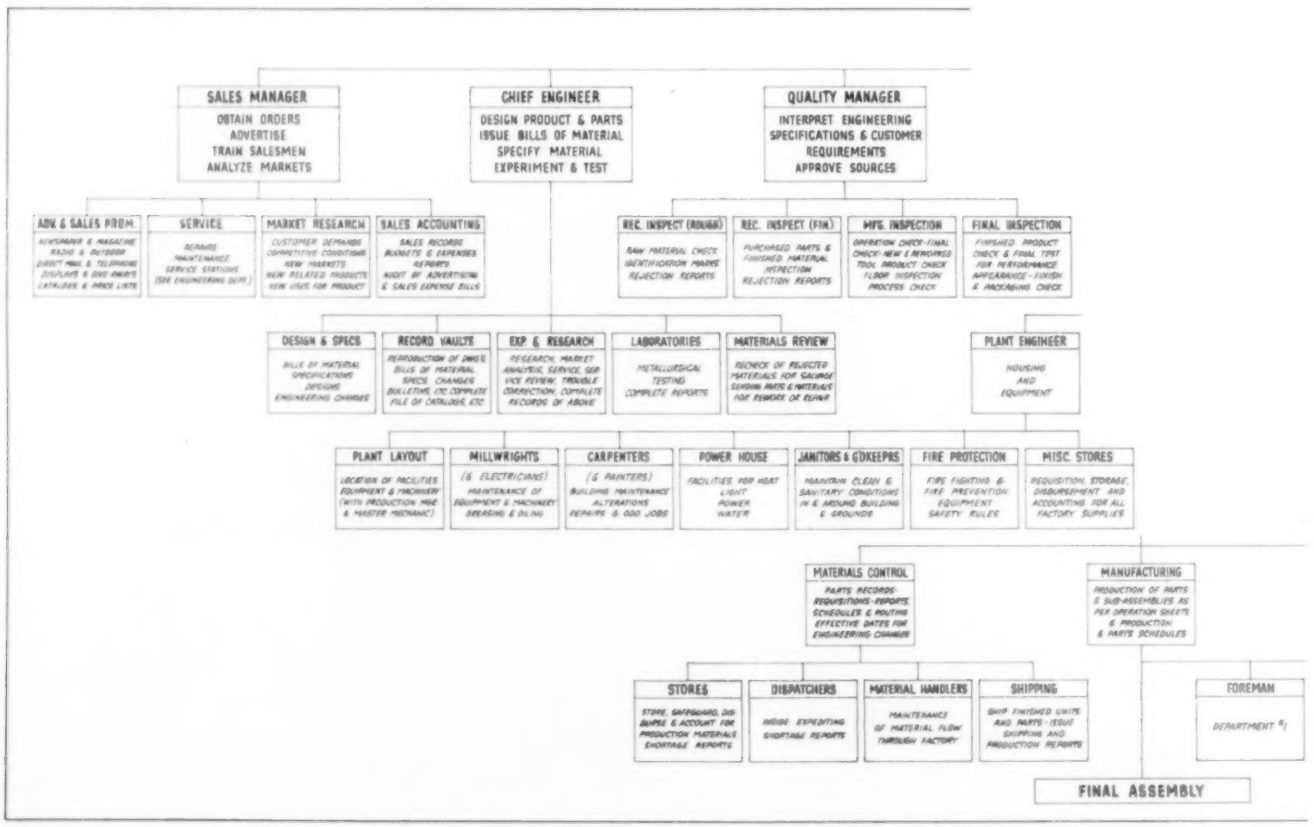
3. With Engineering Dept. in training salesmen, laying out advertising, and in all matters pertaining to product service and maintenance.

4. With Accounting Dept. in all functions of Sales Accounting.

POINTS OF DANGER

1. Lack of coordination with other departments.
2. Inadequate or unwise analysis of market potentials.
3. Excessive, insufficient, or unbalanced advertising.
4. Inefficient organization of sales territories and representation.
5. Poorly trained salesmen and dealers.
6. Excessive sales expense.
7. Improper pricing.
8. Over optimistic sales forecasts.

The charts shown below and on page 31 constitute one complete chart, which may be joined on the center line directly under "General Manager."



FACTORY MANAGER

(Responsible to General Manager)

FUNCTION:

1. Supervise and coordinate all activities of the production plant.

2. Interpret company policies as related to the factory; estimate budget requirements.

SUBDIVISIONS & DETAILS

PLANT ENGINEERING DEPT.:

1. Provide and maintain housing and equipment.

PRODUCTION ENGINEERING DEPT.:

1. Provide machinery and tooling.

PRODUCTION DEPT.:

1. Provide men and material.

NOTE: *See detailed discussion of each department.*

COORDINATION

1. With Quality Manager on ways and means to reduce scrap, improve methods and standardize quality.

2. With Engineering Dept. on designs and specifications.

3. With Personnel Dept. on labor relations.

4. With Comptroller on budgets.

5. With Purchasing Dept. and Accounting Dept. on all requirements.

POINTS OF DANGER

1. Lack of coordination with other departments.

2. Faulty coordination between departments of Plant Engineer, Master Mechanic, and Production Mgr., resulting in poor plant layout, inefficient tooling and processing, extravagant choice of machinery and equipment, and excessive production costs.

PRODUCTION ENGINEERING DEPT.
(Master Mechanic)

(Responsible to Factory Manager)

FUNCTION:

1. Select, design, make and/or requisition all machinery, tooling, and gaging needed to produce product.

2. Process parts.

3. Determine whether parts and tools may be more economically made or purchased, and present findings to Factory Manager for decision.

4. Estimate production costs.

SUBDIVISIONS & DETAILS

CHIEF TOOL ENGINEER:

1. Determine methods, processes, machinery, equipment, etc., to be used.

2. Issue process sheets, giving sequence of operations and designating department, machine and tooling, using standard tools wherever possible.

TOOL DESIGN:

1. Make preliminary layout of tooling called for in process sheets and turn same over to Motion Study for analysis of operations.

2. Complete design in accordance with recommendations.

MOTION STUDY:

1. Consider carefully the preliminary layout of tooling design, as furnished by Tool Engineers, and analyze the physical motions it will be necessary for the machine operator to perform in using same.

2. Study details of operation sheets and plant layout, and make recommendations to Tool Design as to completed tooling, endeavoring to increase efficiency by eliminating lost motion and minimizing trouble and loss of time in setting up, feeding, operating, removing parts and tearing down tooling.

TOOL ROOM:

1. Manufacture new tooling in accordance with design.

2. Rework, repair, and service tooling on instructions from Master Mechanic.

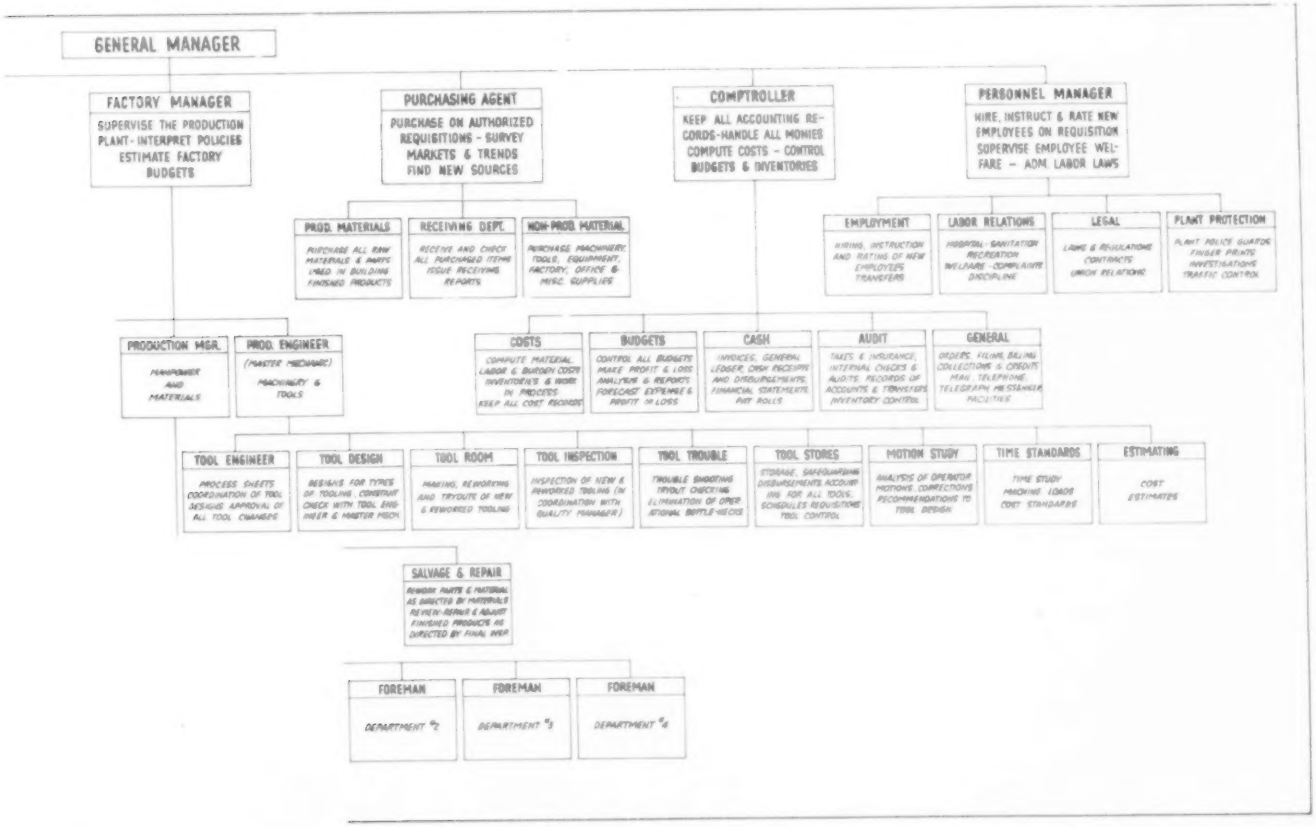
3. Try out new machines and tooling.

TOOL TROUBLE:

1. Check and correct tool troubles.

2. Make recommendations for elimination of bottle necks or inefficient methods or operations.

3. Check tryout of new tooling.



TOOL INSPECTORS:

Check new tooling with print specifications.

TOOL STORES:

1. Stock, safeguard, and account for all tooling received and disbursed.
2. Schedule and requisition perishable tools, and maintain inventories in balance with production requirements.

TIME STANDARDS: (See Motion Study)

1. Study and set up reasonable time allowance for each manufacturing operation; instruct operators as to most efficient methods.
2. Establish standard costs and forward to Accounting Dept.
3. Establish and record machine loads.

ESTIMATING:

1. Estimate cost of manufacturing tooling and parts, in order to (a) assist Factory Manager to determine whether they should be manufactured or purchased and (b) to assist Sales Dept. to estimate prices.

COORDINATION (Through Factory Manager)

1. With Plant Engineer and Production Manager in routing operations and laying out plant to best advantage.
2. With Production Manager for prompt trying out and servicing of tooling.
3. With Quality Manager regarding special processes, finishes, etc.
4. With Quality Manager in checking gages.
5. With Sales Dept., Engineering Dept., Production Manager, Quality Manager, Accounting Dept., and Purchasing Dept. in order to (a) determine if customers requirements are economically reasonable, (b) keep costs within bounds, and (c) establish prices.
6. With Accounting Dept., Purchasing Dept., and Production Manager in requisitioning machinery and tools, scheduling tooling requirements and maintaining inventory.
7. With Accounting Dept. in establishing standard costs.

POINTS OF DANGER

1. Lack of coordination with other departments.
2. Faulty design or unwise selection of machines and tooling.
3. Inadequate or uneconomical plant layout.
4. Excessive or inadequate inventory of tools.
5. Inaccurate time standards and cost estimates.
6. Careless handling, safeguarding and accounting for tools.
7. Unnecessary interference with production.
8. Inefficient or economically unsound sequence of operations on Process Sheets.

PLANT ENGINEERING DEPT.

(Responsible to Factory Manager)

FUNCTION:

1. Lay out plant and requisition equipment in collaboration with Master Mechanic and Production Manager.
2. Set up and place in operating condition all equipment and machinery in accordance with plant layout plans and in close collaboration with Master Mechanic.
3. Grease, oil and clean all machinery and equipment on schedule.
4. Furnish and maintain facilities for heat, light, power, and sanitation.
5. Maintain all buildings and grounds.

SUBDIVISIONS & DETAILS

PLANT LAYOUT:

1. Study building plans and operation sheets; plan location of each department, machine and item of equipment, giving consideration to the following factors:
   (a) Location of railway sidings and other shipping and receiving facilities.
   (b) Type of machines in relation to overhead clearance, floor thickness, and location of service facilities.
   (c) Sequence of manufacturing operations, from part to assembly to final assembly to test.
   (d) Efficiency of handling materials as routed in placing material handling equipment.
2. Determine what equipment is required to support plant layout and requisition same.

NOTE: Plant layout requires such close collaboration with the Master Mechanic and Production Manager that it can really be regarded as a joint enterprise.

MILLWRIGHTS & ELECTRICIANS:

1. Set up all equipment and machinery in proper locations: place in operating conditions.
2. Grease, oil, adjust, and otherwise service equipment and machinery on schedules prepared in such a manner as to minimize interference with operations.

CARPENTERS & PAINTERS:

1. Maintain buildings.
2. Make alterations as required.
3. Perform odd jobs and repairs.

POWER HOUSE:

Set up and operate facilities for furnishing light, heat, and power to entire plant.

JANITORS AND GROUNDSKEEPERS:

1. Maintain office, factory and grounds in a tidy, clean and sanitary condition at all times.

FIRE PROTECTION:

1. Maintain fire prevention equipment and fire fighting apparatus in operating condition and ready for emergencies at all times.

MISCELLANEOUS STORES:

1. Requisition, stock, safeguard, disburse and account for all supplies needed by Plant Engineering Dept.

COORDINATION (Through Factory Manager)

1. With Master Mechanic and Production Manager in laying out plant.
2. With Personnel Dept. in providing and maintaining hospital sanitation and comfort facilities.
3. With Production Manager in establishing inspection, maintenance, and service schedules on machinery and equipment.
4. With all departments requiring services.
5. With Purchasing and Accounting Depts. in requisition of equipment or supplies.

POINTS OF DANGER

1. Lack of coordination with other departments.
2. Impractical plant layout.
3. Interference with promotion due to failure of any facility or for servicing same.
4. Dissatisfaction among personnel due to unsanitary conditions or faulty operation of comfort facilities.
5. Unnecessary depreciation due to lack of diligence in inspection and maintenance.
6. Inadequate fire protection.
7. Excessive inventory or waste of supplies.

PRODUCTION DEPT. (Production Manager)

(Responsible to Factory Manager)

FUNCTION:

1. Issue production and shipping schedules.
2. See that sufficient materials and personnel are available to meet schedules.
3. Produce finished units and parts.
4. Ship finished product as produced.
5. Issue production and shipping reports.

SUBDIVISIONS AND DETAILS

MATERIALS CONTROL:

1. Compile record of each part, showing part number and name, quantity of each per complete unit, material from which it is made, and indicating whether to be purchased or manufactured.
2. Record miscellaneous orders and scrap.
3. Compute lead time—i.e., length of time required on all materials and parts in advance of final assembly.
4. Issue requisitions for parts and material to be purchased and shop orders for parts to be manufactured; schedule delivery or completion dates to meet production requirements.
5. Follow up and expedite delivery of parts and material inside plant.
6. Issue production and shipping reports.
7. Indicate effective dates for Engineering changes.
8. Maintain close liaison with Purchasing Dept. on scheduled deliveries (Through Factory Manager).

MANUFACTURING DEPTS.:

1. Manufacture parts and assemblies in strict accordance with (a) operation sheets and (b) schedules issued by Materials Control.

FINAL ASSEMBLY:

1. Assemble finished product in accordance with Production Schedule. Issue production reports.

STORES:

1. Stock, safeguard, disburse and account for parts and material; report shortages.

DISPATCHERS:

1. See that parts and materials are delivered to use locations as scheduled.
2. Report shortages.

MATERIAL HANDLERS:

1. Deliver parts and material as instructed.

SHIPPING DEPT.:

1. Ascertain that all material to be shipped is properly packaged.
2. Ship finished product and miscellaneous orders.
3. Issue shipping reports.

COORDINATION (Through Factory Manager)

1. With Sales Dept., Production Engineering Dept., Purchasing Dept. and Quality Manager in setting up production and shipping schedules.
2. With Engineering Dept. and Production Engineering Dept. in setting up record of parts specifications.
3. With Sales Dept. and Production Engineering Dept. in setting up spare parts schedule when orders are exceptionally heavy.
4. With Engineering Dept., Sales Dept., Production Engineering Dept., Purchasing Dept., and Quality Manager in establishing effective date for Engineering changes.
5. With Personnel Dept. on manpower to meet schedules.
6. With Quality Mgr., Sales Dept. and Engineering Dept. on proper packaging.

POINTS OF DANGER

1. Lack of coordination with other departments.
2. Too heavy production and shipping schedule.
3. Shortages.
4. Improper lead time on parts and material.
5. Excessive inventory.
6. Improper care of and accounting for parts and material.
7. Improper or delayed handling of Engineering changes.
8. Inadequate and/or unattractive packaging.

QUALITY MANAGER

(Responsible to General Manager)

FUNCTIONS:

1. Interpret engineering specifications and customer requirements.
2. Approve sources of parts and material.
3. Supervise and coordinate inspection and testing facilities.
4. Collaborate with Factory Manager and Engineering Dept. on special processes, finishes, packaging, etc.

SUBDIVISIONS & DETAILS

RECEIVING INSPECTION (Rough):

1. Check raw materials, including castings and forgings, against specifications or prints; send samples to Metallurgical or Testing Labs when necessary.
2. Place identification marks when necessary.
3. Report rejections to Factory Manager and Purchasing Dept.

RECEIVING INSPECTION (Finished):

1. Check finished parts against prints; send samples to Metallurgical or Testing Labs when necessary.
2. Report rejections to Factory Manager and Purchasing Dept.

MANUFACTURE INSPECTION:

1. Check sample parts made with new or reworked tooling.
2. Check parts at specified operations.
3. Maintain continual floor inspection where necessary.
4. Check finished parts against prints.
5. Send rejected parts to Materials Review for possible salvage.

FINAL INSPECTION & TEST:

1. Check finished product against specifications and test for performance.

COORDINATION

1. With Sales Dept., customer, and Engineering (Experimental & Research) Dept. on quality requirements.
2. With Sales Dept. on commitments as to design and quality. (Whether customer requirements are economically reasonable.)
3. With Service Dept., Sales Dept., and Engineering Dept. on correcting defects.
4. With Engineering Dept. on materials review, experimental and research work, metallurgical and testing laboratories operations, and specifications.
5. With Factory Manager on reducing scrap, improving methods and standardizing quality and inspection of tooling and gaging.
6. With Purchasing Dept. on selection of Vendors.
7. With Factory Manager on adequate Salvage and/or Repair facilities.

POINTS OF DANGER

1. Lack of cooperation with other departments.
2. Unreasonable interpretation of specifications.
3. Careless or too strict inspection.
4. Unwise interpretation of customer requirements.
5. Unwarranted interference with production or selection of sources.
6. Faulty performance of finished products.
7. Inadequate or unattractive finishes and packaging.

PURCHASING DEPT. (Purchasing Agent)

(Responsible to General Manager)

FUNCTION:

1. Purchase all equipment, machinery, tooling, materials and supplies needed by entire organization at the lowest price consistent with quality and delivery requirements.
2. Survey markets and price trends.

3. Search for and develop new sources of supply, new materials and processes; maintain cooperative confidence of old sources.

4. Check all requisitions to see that all departments keep purchases within budget limitations, and make sure that excessive inventories are not being built up.

5. Follow up and expedite delivery of all purchased material.

6. Maintain close liaison with Factory Manager on scheduled delivery of production materials.

7. Receive all purchased materials; issue receiving reports.

SUBDIVISIONS AND DETAILS

Receiving Dept.:

1. Receive and check parts and materials from Vendors and forward same to Inspection Dept.

2. Issue receiving reports.

Note: Receive machinery, equipment, tooling and non-production supplies and forward same to department concerned.

COORDINATION

1. With all departments from whom requisitions are received, and vendors.

2. With Quality Manager on selection of Vendors of production material, and quality of materials purchased.

3. With Factory Manager (Production Dept.) on schedules.

POINTS OF DANGER

1. Lack of coordination with other departments.
2. Excessive prices.
3. Excessive or insufficient commitments.
4. Having only one Vendor for production materials.
5. Insufficient number of bids on major requirements.
6. Honoring improperly signed requisitions.
7. Changing quantity, quality or delivery date without consulting requisition sources.
8. Delivery of materials (particularly production materials) not in strict accordance with established schedules.
9. Poor quality of purchased materials.
10. Unreliable Vendors.
11. Loss of good will and confidence of Vendors through unfair treatment, chiseling, or invariable buying on price alone.

PERSONNEL DEPT. (Personnel or Industrial Relations Mgr.)

(*Responsible to General Manager*)

Function:

1. Hire and instruct new employees.

2. Supervise and coordinate all facilities and activities relative to employee health, welfare, and recreation.

3. Act as liaison agency between the organization and labor unions.

4. Administer all governmental rules, regulations, and laws relating to labor relations.

5. Establish and maintain adequate Plant Police Protection; supervise investigations of employee records.

SUBDIVISIONS & DETAILS

Employment Dept.:

1. Schedule labor requirements in accordance with requisitions.

2. Hire new employees, and instruct them as to duties, privileges, regulations, and general company policies.

Labor Relations Dept.:

1. Supervise facilities for employee first aid (hospital), comfort and sanitation within the plant. Guide and cooperate with recreation, entertainment and educational activities.

2. Handle employee complaints and grievances.

3. Administer disciplinary rulings.

4. Supervise and administer other welfare, such as group insurance, financial aid, etc.

5. Collaborate with departments concerned in conducting supervisory training, special employee training, etc.

Legal Dept.:

1. Interpret all government rules, regulations, and laws relative to labor relations.

2. Handle all matters pertaining to labor union contracts and agreements.

Plant Protection:

1. Establish and maintain guard posts, plant patrols, and other police functions.

2. Fingerprint and check records of all new employees.

3. Conduct investigations when required.

4. Protect plant and personnel against fire, riots, sabotage and/or other contingencies.

5. Conduct periodical fire drills.

COORDINATION

1. With all departments requisitioning help.

2. With Plant Engineering on setting up and maintaining hospital and sanitation facilities, and on safety facilities and regulations.

3. With union officials on labor relations.

4. With Accounting Dept. on pay roll and time keeping matters.

5. With municipal or government law enforcement agencies on employee investigation, sabotage, etc., traffic control and regulations.

POINTS OF DANGER

1. Lack of coordination with other departments.
2. Arrogant or unreasonable attitude toward employees.
3. Lax administration of disciplinary rulings.
4. Careless interpretation of labor laws.
5. Friction with labor unions.
6. Inadequate supervisory training.

ACCOUNTING DEPARTMENT (Comptroller)

(*Responsible to General Manager*)

Functions:

1. Establish and maintain all accounting and statistical information and records.

2. Set up and maintain all departmental budgets.

3. Set up and maintain records of costs of labor (time keeping), material and overhead.

4. Audit and pay all bills, including Pay Rolls.

5. Issue invoices and handle collections; control extension of credit.

6. Control value of inventories throughout plant and in all stores.

7. Receive, safeguard, disburse and account for all monies; establish and maintain proper and adequate banking connections.

8. Issue forecasts of profit and loss, financial statements, and profit and loss statements, showing comparisons with previous corresponding periods.

9. Provide proper insurance and/or Surety Bond coverage; handle all taxes, licenses, etc., necessary for conduct of all business transactions.

10. Provide and maintain adequate telephone, telegraph and messenger service.

SUBDIVISIONS AND DETAILS

Costs:

1. Compute and record cost of all material, labor and items of burden or overhead.

2. Keep up to date records of the value of all inventories, work in progress, and all other cost records.

3. Maintain and supervise time keeping facilities.

4. Issue work orders.

Budgets:

1. Under direction of constituted authority, set up budgets for all departments to cover established fiscal periods.

2. See that all expenditures are kept within budgetary limitations.

3. Issue statements of profit and loss periodically or when requested by proper authority.

4. After due analysis, issue forecasts of expenses, probable profit and/or loss, and reasons therefor.

CASH:

1. Receive, bank, disburse and account for all cash; provide adequate banking facilities.

2. Audit and pay all invoices and pay rolls.

3. Issue financial statements periodically or when requested by proper authority.

AUDIT:

1. Maintain adequate methods for checking accuracy and/or honesty of all records and reports; see that surety bond coverage is maintained for all personnel for whom such coverage is deemed advisable.

2. See that adequate insurance coverage for all operations is provided at all times.

3. Check and authorize payment of all taxes, license fees, insurance and/or surety bond premiums.

4. Control all inventory values.

GENERAL:

1. Issue invoices.

2. Maintain filing system.

3. Handle necessary collections and credit items; control extension of credit to customers.

4. Provide and maintain adequate telephone, telegraph and messenger services.

COORDINATION

1. With all Department Heads and General Manager on budget matters, overhead costs, and expenditures.

2. With Personnel Dept. on wage rates, pay periods, time keeping methods and other pay roll matters.

3. With department concerned on inventory controls.

4. With Sales Dept. on price quotations, collections, credit extensions.

5. With Purchasing Dept. on Accounts Payable and discounts.

6. With Factory Manager on labor and material costs (Cost Standards).

POINTS OF DANGER

1. Lack of coordination with other departments.
2. Extravagance or parsimony.
3. Inadequate records.
4. Dishonesty of employees handling money.
5. Inadequate insurance and Surety bond coverage.
6. Inaccurate cost figures.
7. Inaccurate financial statements.
8. Unwise forecasts of expense, profit and loss.
9. Failure to keep records and reports current at all times.
10. Failure to make reports clear and readily understandable, as well as pertinent to matter at hand.

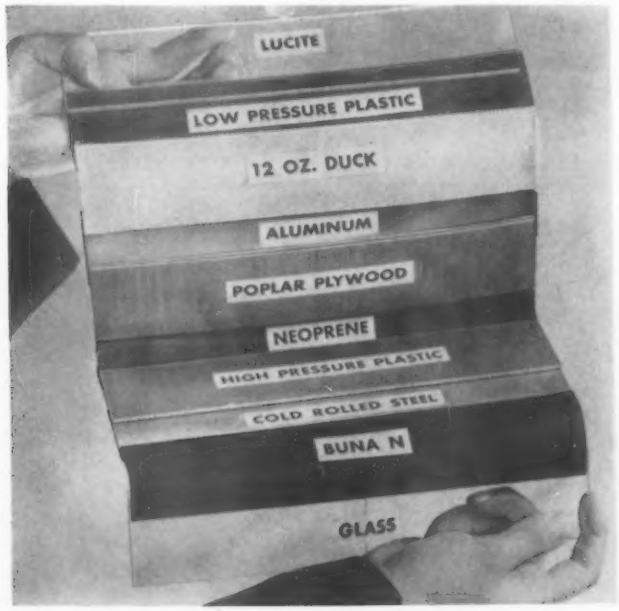
REVOLUTIONARY ADHESIVE BONDS ANYTHING

DEVELOPED BY the Goodyear Tire & Rubber Company Research Laboratory, a new synthetic adhesive—called Pliobond and exclusively distributed by the United States Plywood Corporation—can truly be called the "universal" adhesive. It just about bonds anything to anything, and may be applied either as a cold setting cement or under heat and pressure, depending on requirements and the nature of the work.

Pliobond is an entirely synthetic compound with resin-like properties but, also, with rubber-like characteristics. It stems from a family of new elastomers—or, as they are commonly called, synthetic rubbers. It seems to have an amazing affinity for a very wide variety of natural and synthetic materials.

For example, it has been successfully used for bonding a variety of metals, plastics, fabrics, ceramic ware, vulcanized rubber, paper, leather, glass, plaster, wood and Portland cement concrete. Any of these materials may be bonded each to each or one to another. The bonded assemblies are said to be shock resistant and to possess high shear strength.

Various metals, joined by Pliobond, show the versatility of the adhesive. The strips are held together by various bonded areas yet withstand great weight.



A demonstration of plastic sheets being made ready for attaching to a metal base by spraying Pliobond to the base prior to joining.

A Symposium

The Tools and Techniques for the Production of Precision Gears

Installment No. 3, in which a leading authority explains the "What", "Why" and "How" of Modern Gear Hobbing.

Facts About the Hobbing of Gears

In presenting this pertinent article on Gear Hobbing, we deviate somewhat from our usual practice of introducing the author. This paper, contributed by the Barber-Colman Company, Rockford, Ill., is a collaboration on the part of the Barber-Colman sales and engineering.—ED.

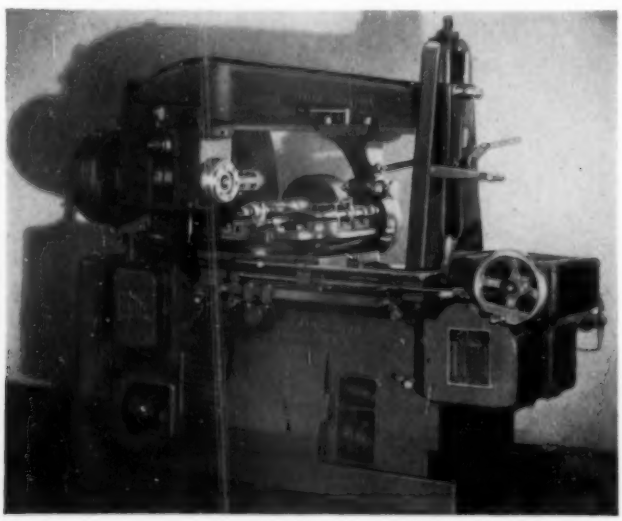
The hobbing method has won for itself a highly important and extensive place in the art of gear manufacturing. Like everything else, hobbing has limitations, but within its proper sphere there are outstanding advantages which have contributed to its present wide acceptance and use.

What Is Hobbing?

Hobbing is the process of cutting gear teeth by advancing a worm-shaped cutter or hob through a revolving gear blank, the respective rotary speed of the hob and of the gear blank being established by the number of threads in the hob and the number of teeth to be cut in the gear. It is understood that the hobbing method had fundamentally been discovered in the year 1856 by Christian Schiele. In 1887, on the basis of the Grant patent, the first hobbing machines for cutting straight toothed spur gears were built. Probably the earliest example of gear hobbing was the hobbing of worm gears. Casting or rough milling worm gear blanks, to a rough approximation of the tooth form required, was the first method of producing these parts. Finishing was done by lapping until a sufficient bearing was obtained with the worm.

This process, however, was slow and awkward, and eventually someone conceived the idea of taking a worm, notching it, and finally forming teeth on it with the requisite cutting edges and clearances. Such a tool was used to machine out gashes in the worm gear blank to the form necessary to properly engage and run with the worm. The gashed or toothed worm was the true ancestor of the present worm gear hob.

FIG. 1. Barber-Colman Universal Gear Hobbing Machine.



At first, the blank was provided with cast or milled notches set at the correct angle and of about the same radius as the hob. The hob was then used to generate the correct form by simultaneously rotating and machining the work. Surprisingly accurate worm gears were produced by this method, provided that the initial gashes were correctly spaced and machined so as to leave as little stock as possible for hob to remove.

Having developed a cutting tool of the form described, a machine was provided to:

1. Rotate the cutter or hob;
2. Rotate the work in correct relation to hob rotation;
3. Have a mechanism to feed hob radially into the work.

This was called a worm gear hobbing machine.

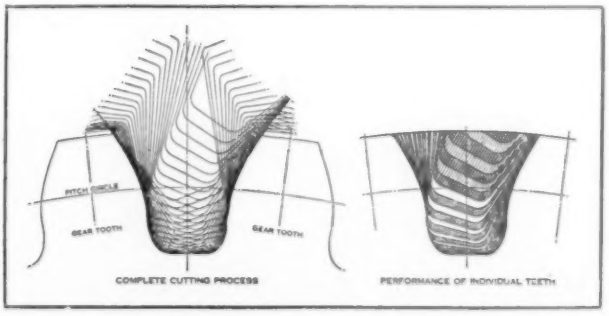
Next, when an axial motion was added to the cutter through suitable carriage, ways, and driving or feed screw, the hob could be fed through the work in a direction parallel to work axis. This arrangement produced a spur gear instead of a worm gear. When a suitable differential was added into the gear trains driving the hob and work, helical gears were produced. The machine then became known as a universal hobbing machine, such as shown in Fig. 1. Helical gears can be hobbed with as few as three teeth. In such cases they become triple-thread worms. See Fig. 1A.

Hobbing Machine

Basic Precision Factors

Machines constructed with the above mentioned motions have several basic advantages:

1. *Continuous rotary motion of work, cutter and feed drive.* This undoubtedly contributes to the amazing accuracy of tooth spacing which modern machines are producing, as



Above, generating action of hobs.

FIG. 1, left.

FIG. 1A, below.

for example, gears in timing mechanisms, dividing gears, gun-sighting gears, and turbine reduction gears, which often run in excess of 20,000 feet per minute pitch line speed. The accuracy now expected of hobbing machines has not been achieved over night, but is the result of many years of test, thought, and development.

2. *Even distribution of heat generated by cutting action around the periphery of the work.* It was found, previously, that when cutting by other methods heat was not distributed evenly around the blank, causing heat distortion.

3. *Continuous indexing avoids errors found when single tooth or when notched plate indexing methods are used.*

Mechanical Precision Factors

The Index Worm and Gear are the most important elements in the machine for precision work. If these two parts are accurately made, and both run true radially and axially in their mountings, gears will be produced with almost identical accuracy unless some other parts of the machine are exceptionally inaccurate.

The Feed Screw also enters the picture, when cutting helical gears, especially those of high helix angles. It must be accurate in lead, run true on its axis and be held without "camming" action, longitudinally, for best results. In the past, "drunkeness" in thread lead was a problem, causing wavy or irregular advance of slide. This condition has largely been overcome by improvements in thread-chasing, milling, and grinding equipment.

All active parts of the machine have some effect on the work, but to a smaller degree than the worm, worm gear and feed screw. For example, the drive to the hob must be sturdy, as torsional deflection may occur and disturb proper synchronism of work and hob spindles. Feed, index and differential change gears, mounting and drives must be considered. See Fig. 2.

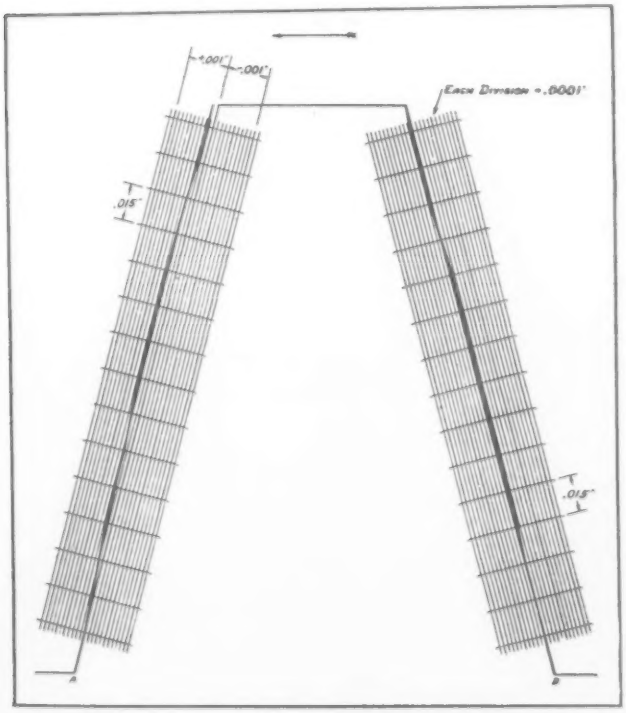


FIG. 2. This is a typical chart, "lifted" from the Barber-Colman booklet —"Helical Gears"—which deals with an extensive investigation, by Barber-Colman Company, to determine causes of inaccuracies in helical gears. The complete booklet treats these causes and shows means for producing helical gears that are consistently accurate.

Various guides and sliding members, gib adjusted, must move freely but without looseness, and especially without intermittent binding, for precision work. As to accuracies to be expected from modern machines, we refer the reader to A.G.M.A. literature, "Gear Inspection and Tolerances." Also, in the literature of gear manufacturers, gear tolerances are often given for various classes of work.

Production Factors

Rapid production is, in many instances, more important than higher degrees of precision, although a high degree of accuracy is required even on production work. Accuracy is also required when one or more subsequent finishing operations are planned, such as shaving, grinding, or lapping. In fact, gears considered suitable for subsequent finishing, such as shaving, are frequently held to the same close tolerances as previously finish-hobbed.

Rapid production presents many problems not involved where precision is paramount. Usually, we have to consider production per man, or per machine, and other matters such as operator convenience, fatigue, floor space, work handling, chip disposal, horsepower, and machine maintenance.

Change Time

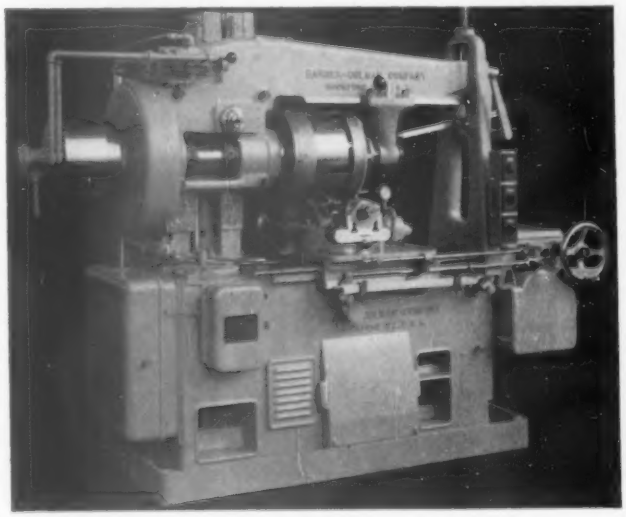
Production—or pieces produced per hour, or other unit of time—depends on two main elements: *Change Time and Cutting Time.*

Change time covers both loading and unloading of work, and should embrace an allowance for resetting hob and for changing hob. This is non-productive time, with the machine stopped, and should be held to a minimum. To accomplish this, gear blanks should be free from dirt, chips or burrs. Holes and other locating surfaces should be held within specified limits so gears can be readily and quickly loaded on holding equipment.

Wherever possible, blanks should be held by air or hydraulically operated collet or holding chuck. See Fig. 3. Heavier work may require mechanical loading helps such as slings, hoists and jib-cranes. On smaller jobs, change time may be shortened by the use of quick change arbors. Further reductions in change time may be made by automatic withdrawal of hob from work, return of hob slide, and stopping of machine.

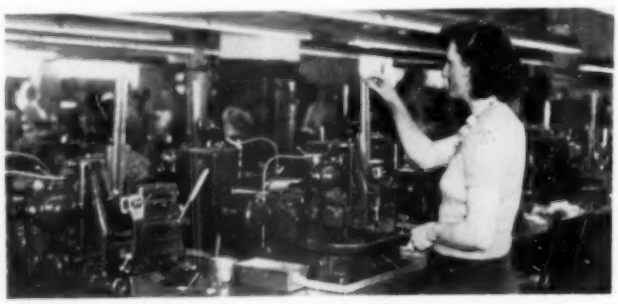
Change time is also machine idle time. Reduced change time is a clear gain, giving increased productivity with but little more effort or fatigue. In some special installations the

FIG. 3. Whenever possible, gear blanks should be held by air or hydraulically operated collets or chucks.



operator loads the machine, engages the feed lever, and the machine automatically cycles, stopping in the same position each time, to facilitate the removal of work and reloading.

Machines doing smaller classes of work, where parts conform, may be magazine fed, requiring only an occasional hob shift or change. One operator has readily handled as high as 8 machines under this arrangement. See Fig. 4.



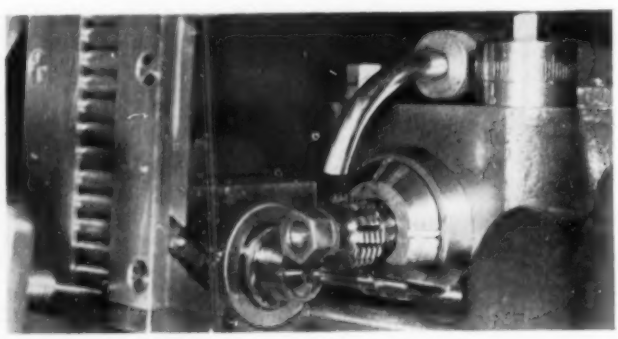


FIG. 4. Magazine feeding of small parts permits one operator to run a battery of machines. Detail of magazine feed in lower illustration.

Cutting Time

Cutting time is the actual time consumed in the cutting of teeth or other forms on the blank. When this time is added to change time the total is known as floor-to-floor time. Floor-to-floor time is further extended by considering 80 to 85% efficiency for the operator. When floor-to-floor time is given it can be multiplied by 1.25 for 80% efficiency and 1.18 for 85% efficiency. This may be established in still another manner by considering that the machine will actually be producing parts only 58 minutes per hour (80%) or 51 minutes per hour (85%). Firms sometimes use slightly different figures according to their particular practice and experience.

Cutting time is the sum of three items: (a) approach time, (b) cutting time with cut to full depth, and (c) and in the case of helical gears, emergent time or time centerline of hob requires to complete generation after hob centerline has reached end of work. Cutting time is determined by speed (RPM) of hob, or surface feet cut per minute (SFM), and feed or advance per revolution of work. To calculate cutting time proceed as follows:

$$\text{(Spur Gears)}\quad T = \frac{N \times (L + O)}{F \times R.P.M.}$$

$$\text{(Helical Gears)}\quad T = \frac{N \times (L + O + P)}{F \times R.P.M.}$$

in which: T = cutting time in minutes, N = number of teeth in gear to be cut, L = distance between the outside faces of the work, O = overrun of the hob, or the distance traveled from the time it first touches the work until it reaches full depth.

P (Helical Gears) = emergent distance or distance hob emerges on leaving helical work to complete full generation. (L − O − P therefore represents the total distance traveled by the hob while cutting.)

F = feed of the hob in inches per rev. of the work, R.P.M. = revolutions per minute of the hob.

If a multiple thread hob is used, the number of teeth (N) in this formula must be divided by the number of threads in the hob.

Feeds used with double thread hobs ordinarily may be 60 to 75 per cent of those used with single thread hobs. This gives increased production as the work is turning twice as fast. In some cases, however, the same feed may be used and the cutting time will be reduced to half. The feed possible is usually restricted by finish requirements rather than power in the machine or strength of the hob teeth.

Cutting speed depends on several factors: the design of the machine, the holding means, design and rigidity of hob and arbor, material used for the hob, and material and rigidity of the work. Cutting speed also influences hob life. High speeds cause excessive heat and may draw the temper in the hob. If the hob wears too rapidly, tool cost becomes too high. Quality, quantity, and application of coolant also has an appreciable effect both on speed and resultant finish on work and wear on hob.

In general, a balance must be struck where production speed is such that neither the machine nor the hob will become overheated or overloaded, and long runs can be made without too much maintenance on the machine or undue wear of the hob.

Cutting speed is also affected as much by pitch as by other factors. This is because the amount of metal removed is much less on fine than on coarse pitches. We might think that 8 pitch would be half of 4 pitch, as $\frac{1}{8}$ is half of $\frac{1}{4}$, in regard to amount of metal removed. Actually, the amount of metal removed varies inversely with the square of the pitch so that 8 pitch is to 4 pitch in this respect as $\frac{1}{64}$ is to $\frac{1}{16}$ or 1 to 4.

Tooling or Work Holding Equipment

This is extremely important in the hobbing process as, without properly designed tooling, the best hobbing machine made will be handicapped as to precision, production, and change time. Each design of workpiece may offer a separate problem which is best solved by competent and experienced Tooling Engineers.

By "Tooling" we refer to all holding, driving and locating means used, of which there is an endless assortment. This may be accompanied by changes in the machine itself, or to meeting the requirements imposed by the product. Holding equipment must have certain qualifications—it must center the work as accurately as possible, must be strong enough longitudinally to clamp the work—especially for helical cuts, so that it cannot turn under pressure and vibration of cut—and it must be as rigid as possible both transversely and torsionally.

This last point is extremely important, as any hobbing arbor or holding means, if not torsionally rigid, will permit spring of work. This tends to destroy accuracy of spacing of teeth and may also affect the accuracy of the angle on helical gears.

The workpiece should be driven from the largest practical diameter of the machine spindle, without any small diameter between the drive and the piece. The tooling should support the workpiece as closely to the root diameter of the gear teeth being cut as possible. Sometimes, of course—as in spline shafts—the drive may have a larger diameter. See Figs. 5 and 5A.

Work will fall into two general classifications:

1. Bar work, as spline shafts and small pinions.
2. Hollow work—i.e., work with a hole through it, as ordinary gears, ring gears and similar.

Bar Work is usually supported on one or two centers and driven by an ordinary milling machine dog clamped between opposed set screws. This drive, while cheap, simple and adaptable to hobbing work, has the disadvantages of being slow and weak torsionally. A collet type drive, powered either pneumatically or hydraulically, is usually preferred on production jobs. Sometimes, holes in flanges or projections on the piece may be used as driving means, depending on the shape of part to be hobbed.

Hollow Work, such as plain gears with center hole, are usually hobbed on a straight arbor, supported by flanges reaching almost to root diameter of the gears. Clamping may be accomplished by a plain nut tightened by wrench, by slotted or "C" washer, or by bayonet lock. In these two

FIG. 5. Detail 1. Centers and quick change arbor. Work supported on centers, both ends locked, which drive by means of flats, or arbor, fitting slot in the driver.

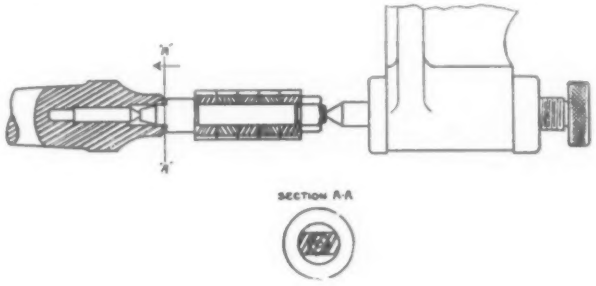


FIG. 5. Detail 2. Floating jaw and ball bearing center. Work is supported and trued on centers. Spindle center is a keyed press fit, with tail end running on live center. Work is clamped by expanding chuck, free floating for work alignment.

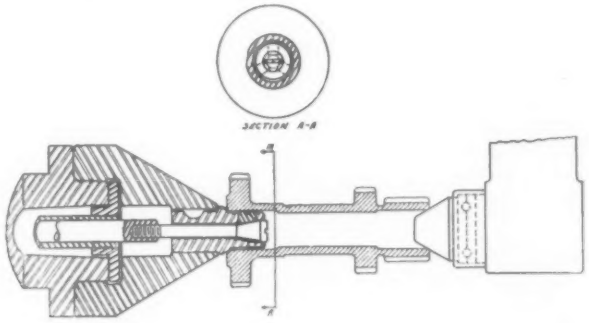


FIG. 5. Detail 3. Work located between centers, but held by floating chuck without disturbing accurate centering.

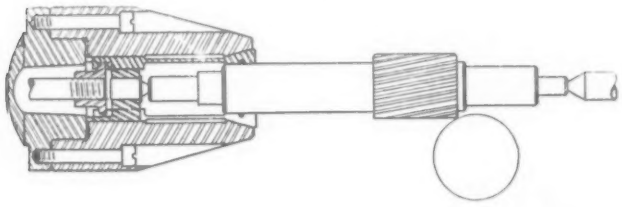


FIG. 5. Detail 4. Work held between centers with spindle center held in spindle taper. Drive is by floating chuck which securely clamps workpiece without disturbing alignment.

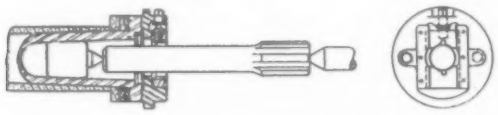


FIG. 5. Detail 5. Sleeve and demountable ring. Work carried on two light spiders having hardened and ground bushings and hardened and ground wear plates on periphery.

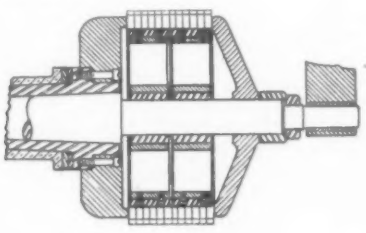


FIG. 5. Detail 6. Work held by draw-in collet supported in detachable collet sleeve. Outer end of work supported by standard adjustable center.

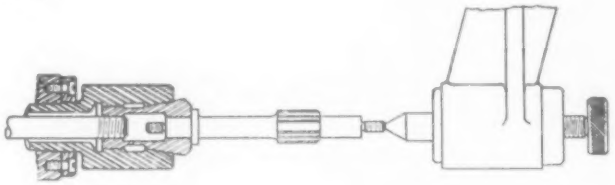


FIG. 5. Detail 7. Sleeve and bayonet lock. Work supported on hardened and ground sleeve and clamped by a flanged bushing which slides in bronze bushing in overhanging arm.

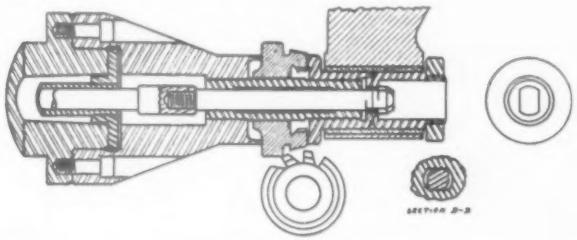


FIG. 5. Detail 8. Arbor and Sleeve. Work held in multiple on solid arbor and clamped by two hardened and ground collars. Arbor carried in taper hole of spindle and supported in bronze bushing in overhanging arm.

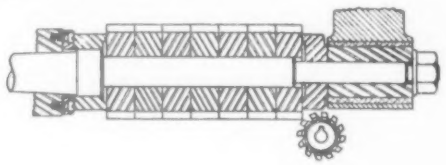


FIG. 5. Detail 9. Collapsible Arbor. Work held on a series of expanding wedges which are expanded by spring pressure only. Clamping is by air or hydraulic pressure, with outer end of arbor supported on bronze bushing.

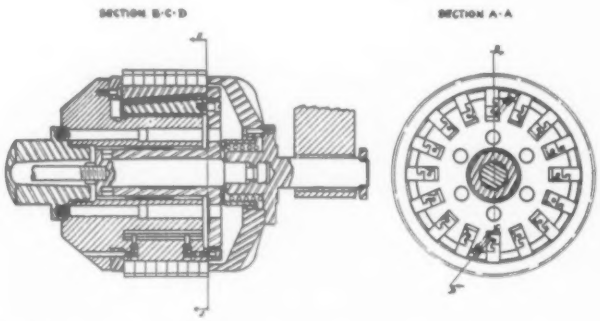
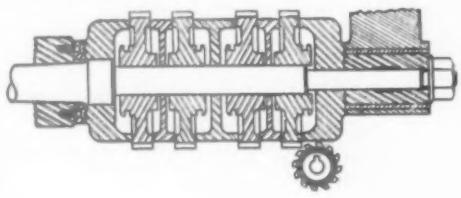


FIG. 5. Detail 10. Arbor and Spacer. Work held on plain arbor and clamped against flanges at each end and intermediate spacing collars between each pair of workpieces. Outer end of arbor runs in a hardened and ground sleeve.



latter cases power, either pneumatic or hydraulic, is generally used for clamping. Holding means in general have to be designed with all factors in mind, such as the machine, cost, accuracy, production, time required to load and unload, etc. After years of experience and hundreds of applications, holding equipment designers can quickly produce economical and practical designs.

FIG. 5A. Detail 1. Collet and draw rod. Work held in collet and adjustable center. Collet is actuated by handwheel and draw rod.

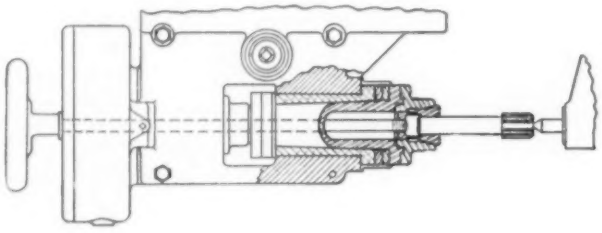


FIG. 5A. Detail 2. Collet and air cylinder. Work is held in a collet operated by air cylinder which rotates with the spindle.

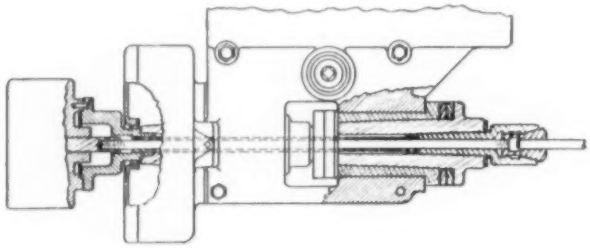


FIG. 5A. Detail 3. Nut operated collet. Work held in collet and center. Collet is closed by a pin or wrench operated nut mounted on detachable collet nose. Assembly is supported in spindle taper.

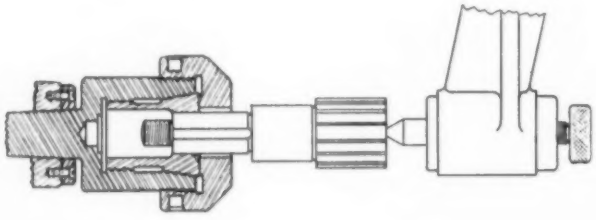


FIG. 5A. Detail 4. Floating chuck for long work, in which work is supported in bushing and tail center. Work is clamped by a floating chuck which grips and locks without disturbing accurate centering.

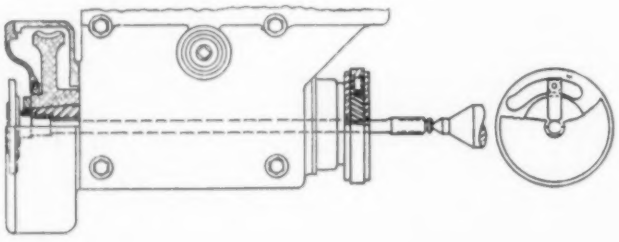
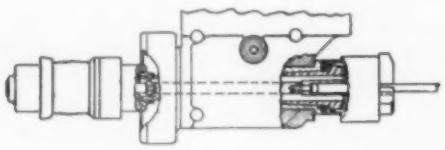


FIG. 5A. Detail 5. Electric chuck and collet. Work held in chuck or collet operated by electrically actuated closer mechanism mounted on and rotating with the spindle.



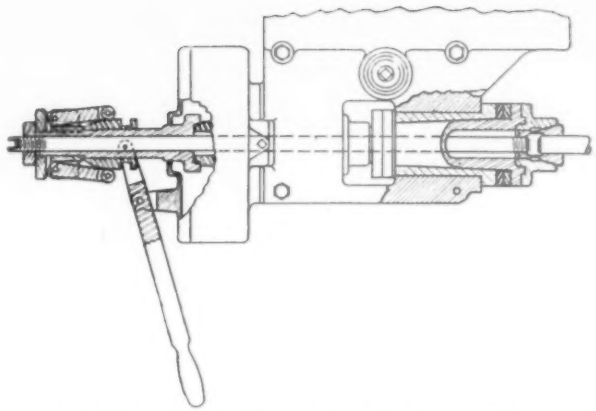


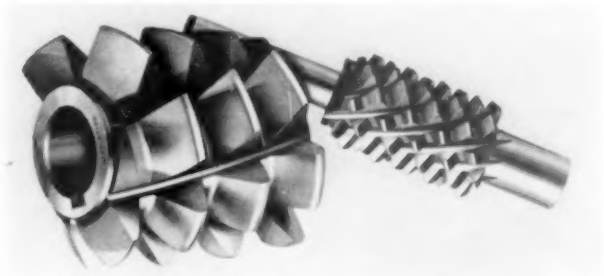
FIG. 5A. Detail 6. Lever operated collet. Work held in collet closed by conventional type lever, cone and finger mechanism which operates draw rod with adequate power.

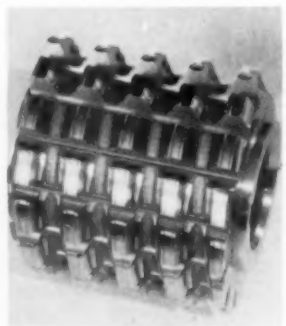
Hobs. Material and Heat Treatment

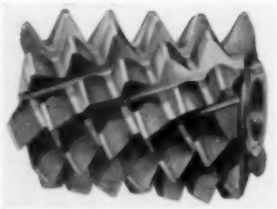
Having considered briefly hobbing machines and holding equipment, we now discuss the cutting tool—the *Hob*. Selection and use of the correct hob for any job is very important as it governs the output of the machine. Types of hobs are shown in illustrations. Fig. 6. This subject is becoming more complex daily. Usually, the hob is one of several standard types of H.S.S. with regular heat treatment. Occasionally, various alloys and heat treatment are used for obtaining higher surface hardness. Carbide-tipped hobs have more recently been developed and have proved especially successful on various types of plastics.*

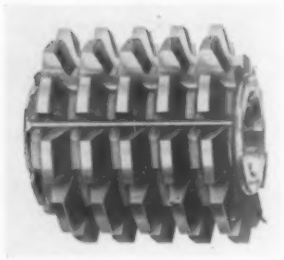
*See "*Carbide Hobs Enhance Quality and Production*," February THE TOOL ENGINEER.

FIG. 6, showing various types of Hobs.









Hob Designs

Threads:

Single; Multiple; Right Hand; Left Hand.

Gashes:

Various numbers depending on diameter and pitch.
Straight or Helical.
Right Hand cut or Left Hand cut.
Radial teeth; Rake teeth.

Driving:

Bores straight or tapered.
Keys clutch or straight.
Integral shanks for small hob diameter to avoid interference.
Straight or tapered shanks.

Size:

½" diameter, 250 D.P. pitch to $10\frac{3}{4}$" diameter, 1 D.P. pitch.

Types:

Generating; non-generating; single position; multilated tooth; elongated tooth; ground form up to 200 D.P.; unground form up to 250 D.P.

Special Features:

Topping for finishing O.D. of work.
Protuberance for undercutting gear tooth.

Multiple Thread Hobs

In considering hobs from a production standpoint, multiple thread hobs offer a considerable increase in production over the single thread type.

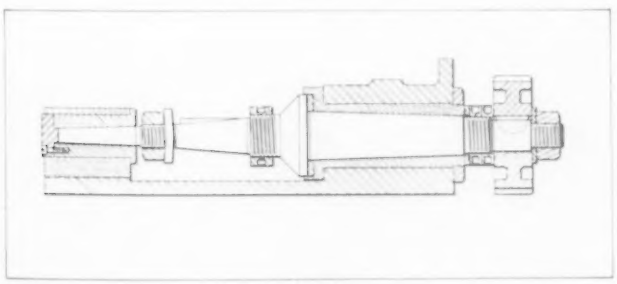
This has been shown in the recommended feeds and speeds for hobbing as published by Barber-Colman Co. in 1924. However, until a few years ago, these hobs were not widely used in the field, despite their economy, because not enough attention was given to the hob running true on the machine. However, due to recently developed manufacturing techniques, accuracy of double thread hobs has become comparable with that of single thread hobs and they are now being used for many accurate high production runs.

Hob Life

How many gears will a hob cut? How many gears should it cut? These are common questions difficult to answer because of many variables. To make comparison easier, we consider the basis of hob life *in terms of linear feet of tooth produced per setting of hob before dullness of approximately .015" is reached.* This assumption enables us to make the proper evaluation for hob life quite readily. The formula then becomes: linear feet per setting × number of settings used × number of sharpenings at .015" per sharpening = total linear feet cut per useful life of hob.

The number of sharpenings possible is the useful length of hob tooth divided by .015". We have found that hob life varies with material and heat treatment, machine condition, coolant used, material cut, and feed and speed used. Hob life may vary from 2,000 to 10,000 feet, average conditions being about 5,000 feet (when cutting annealed steel), or 50 feet per setting. Actual life may be easily determined by a sample run and a microscopic examination of resulting dullness on hob tooth showing the most wear.

FIG. 7. Taper hob arbor.



Number of Settings

Number of settings depends on depth of cut, pitch, diameter of work, and length of hob. Either end of the hob must not be adjusted too closely to center of work as this may result in imperfect generation of work and breakage of hob teeth. Length of hob and work contact, depending on the helix angle and depth of cut, will cause fewer settings when cutting helical gears than when cutting spur gears. The higher the helix angle, the fewer the settings obtainable. The hob is frequently moved one circular pitch or one tooth at a time, but this is not essential as some people shift a fraction of one circular pitch obtaining as high as 10 and 12 settings in some cases. We consider the amount of shift, with a good hob, rather immaterial as long as teeth are dulled as uniformly as possible.

An economical balance should be sought between saving of hob by numerous settings, and loss of man and machine time involved. The ideal condition is an automatic hob shifter which shifts a predetermined amount, with resulting increased hob life and decrease in man and machine time.

Taper Hob Arbors

Such arbors have been in use for several years and have many advantages. See Fig. 7.

1. They are several times more rigid, both transversely and torsionally, than straight arbors due to the enlarged section at driving end being next to the spindle bearing.
2. They provide a close fit, with absolute metallic contact between arbor and hob, regardless of wear in either member.
3. Hob runs true within .0003" maximum (usually less), without the customary hammering or tapping of hob as required to true hob on straight arbor.
4. Hob runs naturally true and not in a strained position, induced by hammering, and does not tend to change position under stress and vibration of cut.
5. Taper arbors are provided with push-off nut to remove hob and an equalizing washer to avoid any possible distortion when tightening nut to clamp hob.

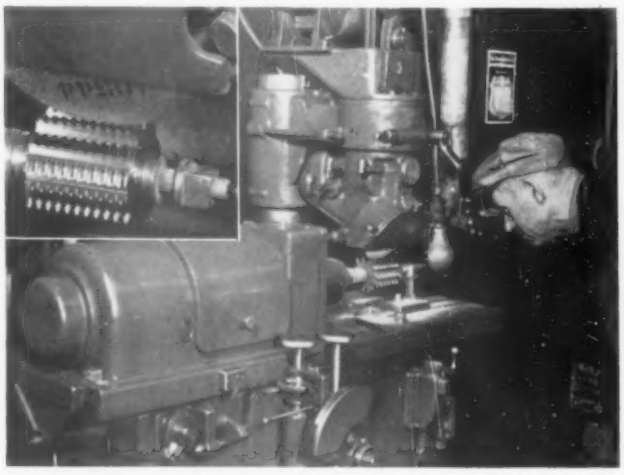
Sharpening

The growing demand for closer working tolerances, longer tool life, and the necessity of producing more parts in less time have placed increasing emphasis on proper hob sharpening.

Frequent sharpening is recommended to avoid the necessity of removing an excessive amount of stock, to increase the hob life, and to maintain the quality of work.

It is very important to guard against overheating during the sharpening operation to eliminate surface burn or annealing, and to prevent the development of heat cracks.

FIG. 8. Sharpening hobs by positive-controlled mechanical means insures accurate duplication of original sharpening.



The wheel should be frequently dressed to maintain sharp cutting qualities, and not allowed to glaze over.

Thus, the term "Proper Sharpening" not only includes keen cutting edge, but also a tooth surface free from burning or heat checks, with a high surface finish, and accuracy. A hob will not produce good work unless properly sharpened. Hob must have equally spaced teeth with radial faces, or correct rake angle when specified.

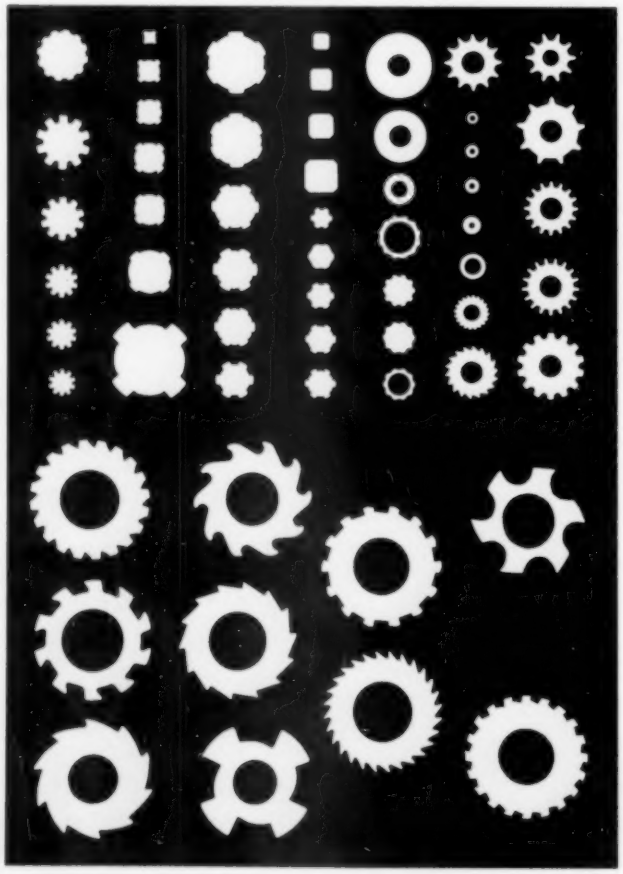
Straight gashed hobs should be sharpened parallel with hob axis. Helical gashed hobs should be sharpened with correct lead of gash. There are good reasons for this accuracy, as any departure from it will result in a distortion of tooth form to a greater or less extent. For example, if an equal amount of stock should be removed from the face of all flutes except one, this row of teeth will then be higher or lower than the rest. The result will be a ridge or groove on the bottom and sides of the work, spoiling the correctness of involute or other form required.

Sharpening hobs by a positive-controlled mechanical means is always recommended as the only method by which accurate duplication of original sharpening can be insured. See Fig. 8.

In some cases it is possible that this type of mechanical equipment will not be available, when other means must be used. If controlled mechanical sharpening is not available, the next best method is to use sharpening guides—or formers—with a guide finger traveling in the flutes to maintain the correct spacing and lead angle of gash on the hob.

It has been found that errors in hob sharpening tend to become progressive when using this manual method, and gradually get worse under repeated sharpenings. It is also desirable to have a good means for checking sharpening in its different phases as outlined above.

FIG. 9. In addition to cutting gear teeth and splines, hobbing will advantageously produce squares, ratchets, serrations and many other toothed shapes.



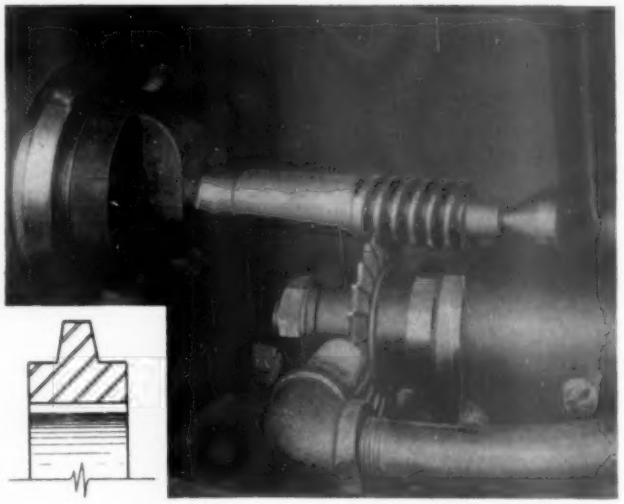
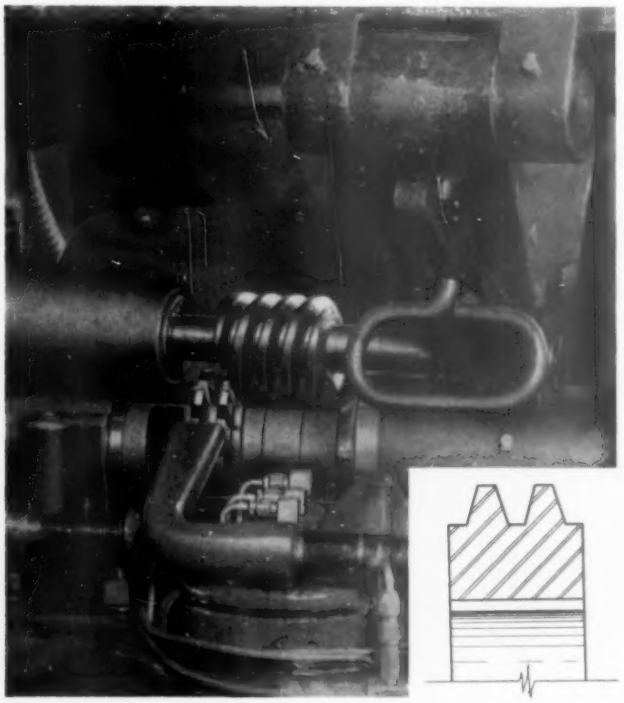
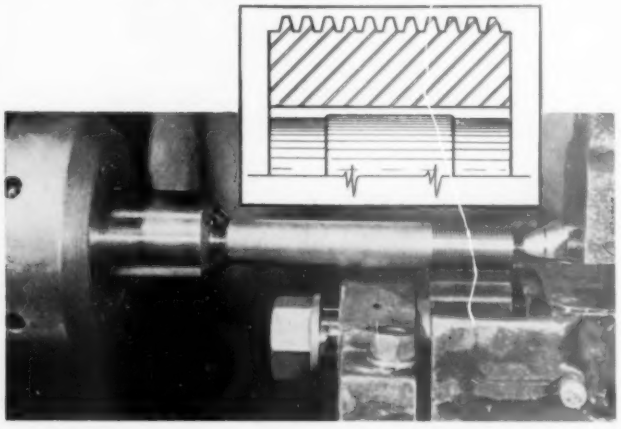


FIG 10 (3 illustrations). Where worms cannot be hobbed, hobbing machine can be set up as a thread miller, using single, double or multiple cutters, as required. Above, milling single thread; below, milling double thread.



Below, milling multiple thread on a hobbing machine.



Hobbed Forms

Hobbing is often referred to as a process for cutting gear teeth and splines, but actually the process can be advantageously used to produce squares, ratchets, serrations and many other forms, requiring only the suitable form of hob. See Fig. 9.

There are three requirements for hobbing:

1. The work should have a regular series of projections or indentations equally spaced and of similar form. Sometimes irregular forms may be hobbed if the irregularities come in uniform groups with occasional teeth removed. (Fig. 9.)

2. The form should have sufficient width and depth so that the hob teeth can freely roll in and out of their generating path.

3. There should be room for the hob to complete its cut without striking collars, flanges or other obstructing parts of work. When such cases occur, clearance may sometimes be obtained by using a small diameter hob.

Part prints or samples of special forms should be submitted to manufacturers of hobbing equipment for consultation as to suitability of the hobbing method.

Various Types of Work

Thread Milling

The hobbing machine can be used to hob worms with a minimum of three threads—or starts—and, occasionally, on special pieces with two threads. The hobbing method is unsuitable for single thread worms and usually for double thread worms, because the hob and worm must be geared to a 1 to 1 or 1 to 2 ratio. The number of rows of teeth, or gashes, on hob will equal the number of cuts (chips) per revolution of work. This action makes chip per tooth too heavy, resulting in poor finish.

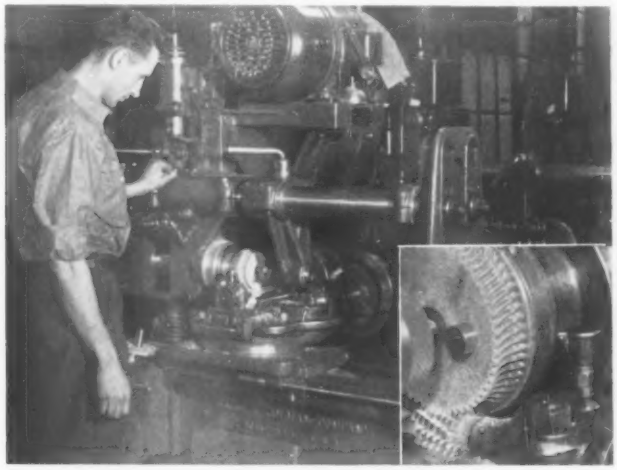
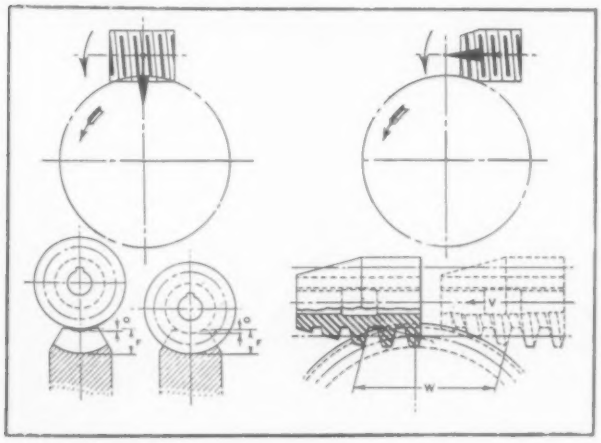


FIG. 11 (2 illustrations). Hobbing is the only practical method for producing worm gears.



In cases where worms cannot be hobbed, the hobbing machine may be set up as a thread milling machine, using a single or multiple type cutter. See Fig. 10. Procedure is as follows: mount the thread milling cutter on the hob arbor; set feed gears to produce the required lead on work; select index gears to rotate work at proper cutting feed. A special hob slide may be necessary for certain work designs.

Milling cutters are made annular or without lead, cutting as in any thread milling machine. General construction of hobbing machine with both inboard and outboard supports both for cutter and work lends itself well to this method, which can be used for quite large cuts and heavy production. See Fig. 10.

One objection to this method is the difficulty, more especially on larger diameters of work, of obtaining a slow enough speed of rotation for the work spindle and in some instances machines are equipped with a dual ratio, slow and fast, for index gears.

Speed of rotation of work is figured by using cutter rpm and number of gashes as a base. A suitable chip per tooth—

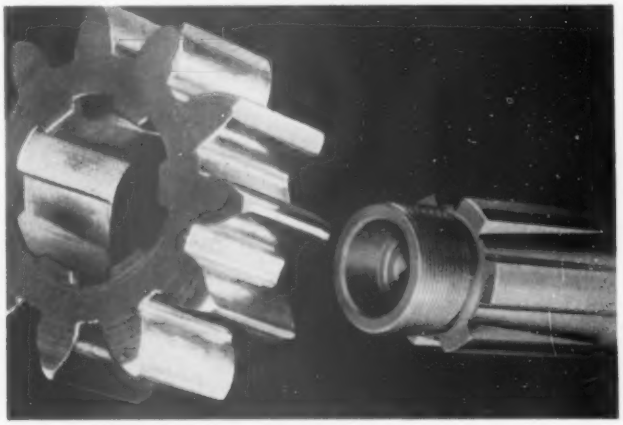
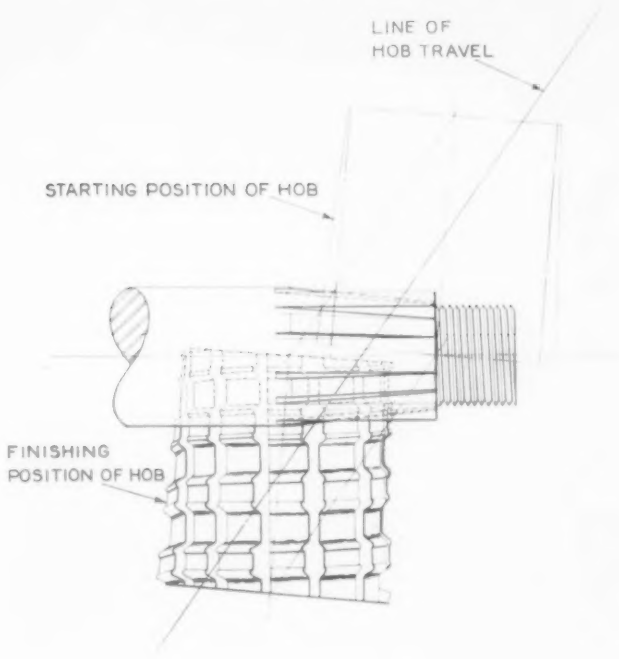


FIG. 12 (2 illustrations). Splines with tapered root diameters.



usually ranging between .005" and .0040"—is determined and peripheral speed of work is arranged accordingly. Suitable gears are then selected for the index train.

On some work a multiple thread mill is used which has as many rows of teeth as there are threads on the work. In this case, one revolution of work, plus the necessary overrun, completes the piece.

Worm Gear Hobbing

This operation, already referred to in general, is natural to the hobbing machine as it is the only type of machine capable of producing these gears. (Fig. 11.) Two methods are in general use. The most common is the infeed method in which the hob is fed radially into the work. Another method used is tangential feed. In this case the hob is fed tangentially across the work, which rotates in geared ratio with the cross-travel of the hob. The entering end of the hob should be tapered. The last convolution, or part of it, finishes the teeth to correct size and form. This method has the double effect of breaking up tooth marks and distributing errors in hob teeth over the gear, so that a very smooth and accurate worm gear tooth is produced.

Some difficulty is experienced, at times, in selecting a suitable feed for infeed or for tangential feed methods. A simple method is to calculate the time required to hob a spur gear whose face width would be the equivalent of the proposed full width of cut; then, set the infeed or tangential feed at such a figure that the worm gear will be produced in the same time as the spur gear. This will give a much finer feed for the infeed method than the usual spur gear feed, and a much coarser feed for the tangential method. The machine will be removing the same amount of stock in the same time in either case, although the cutting action is somewhat different.

Taper Splines

This engineering development provides splines with a tapered root diameter, and straight and parallel or involute sides of keys. Tapered root may be made any desired taper for permanent fit or for easy removal. The hub is usually prepared by boring a taper hole, and pulling through a standard type of spline broach. See Fig. 12. The shaft is hobbed on a special machine using a tapered hob which travels across the work in an oblique direction. The hub is tightened on the shaft by a nut, pulling the tapers together in a tight and self-centering fit. The keys fit in keyways in the hub, giving strong and positive drive. This type of fitting, as shown by tests, gives a drive with torsional strength equal to 85% of the solid shaft. This design has been widely accepted, especially for agricultural, automotive, and military use, without record of failure.

Tapered Serrations

This type of fitting is largely used in the automotive industry for steering shaft members, as described in S.A.E. handbooks and are practically all hobbed as far as we know. In the past, machines have been built with an angle between work spindle and bed ways arranged to give the angle required. This angular setting is usually an integral part of the machine and is unchangeable except by rebuilding the machine. A later development has been made in which

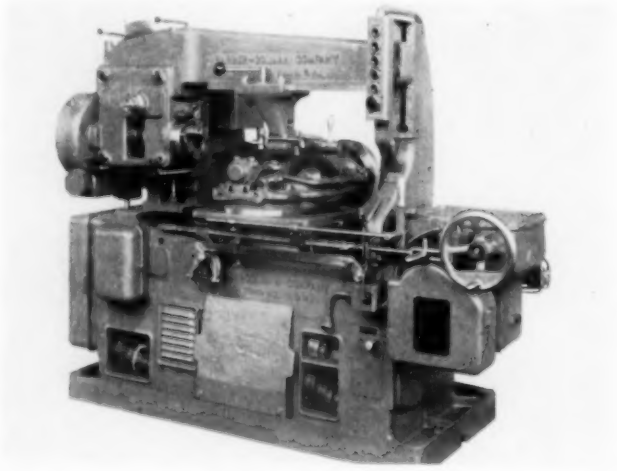
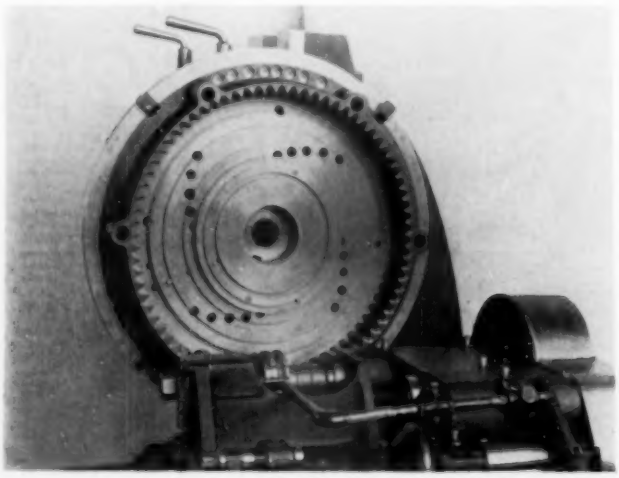
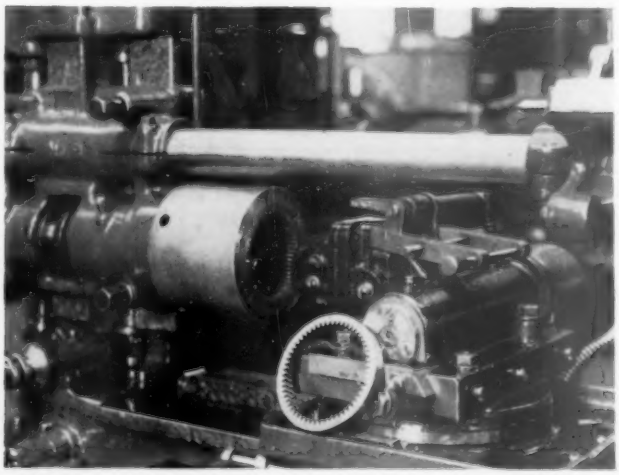


FIG. 13, above. Barber-Colman hobbing machine with angular setting. FIG. 14, below. Set-up for internal hobbing.



Above, FIG. 15; below, FIG. 16, showing set-up for internal gear chamfering.



the work slide and overarm of the machine swivel, and can be set at will to hob parallel, as in a standard machine, or to hob angles up to 5° on a side (10° included). This machine can then be used for any angular or taper work, within its limits, and can be also used on regular straight work at any time by simply releasing clamps and setting heat at zero. See Fig. 13.

Internal Hobbing

It is also possible to hob internal gears. The operation requires a special hob slide with projecting arbor to enter the work; also a properly designed hob. It is important that the hole in the work is large enough to admit the hob and drive gear mounting. Both spur or helical internal gears can be hobbed; accurately spaced, multiple-start threads have also been produced in this manner. In cases where the teeth or threads run close to an internal flange or shoulder, the angle of helix in hob and work can be made to roughly coincide. The axis of hob will then be approximately on same line as axis of work and face of hob will closely parallel face of internal shoulder. Naturally, some neck or clearance will be needed, but less than required for usual set-up. See Fig. 14.

Tooth Chamfering

Hobbing is frequently used for chamfering external and internal gear teeth. A special hob is required. A standard machine may be used for external work, and a standard machine with special hob slide for internal work. An example of internal chamfering is shown in Figs. 15 and 16.

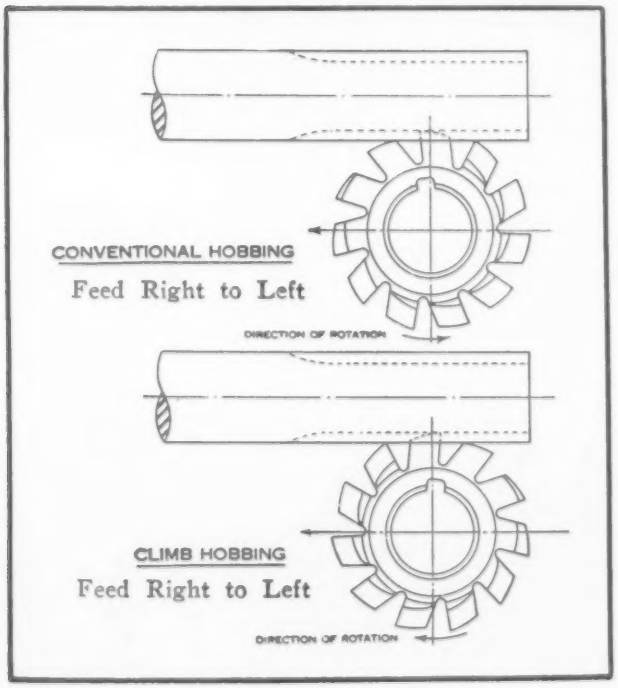
Occasionally, hobbing and chamfering can be combined by using two hobs, a second hob for chamfering being mounted on an auxiliary hob slide. This results in saving of set-up time and extra handling of the part.

Conventional Hobbing

Conventional hobbing was the only recognized method used for many years. However, on high angle helical gears the action was actually climb hobbing, although this was not recognized. Conventional hobbing takes place when the cutting action is in the same direction as the feed, as shown in sketch. Fig. 17.

Climb Hobbing

Climb hobbing takes place when the cutting action is in a direction opposite that of the feed, as shown in sketch. There are apparently no hard and fast rules governing the use and application of climb hobbing. Under certain conditions, however, this climb cut method has resulted in better work. Two principal advantages are usually obtained with climb hobbing. One is increased tool life and another is improved finish. The success with which either of these advantages is obtained varies considerably, depending on the material being hobbed.



As the hob teeth enter the cut at full depth, a kind of combing action takes place which eliminates chips clinging to the hob teeth that, ordinarily, would cause tears and gouges as they pass through the cut. Machines and hobs can usually be adapted to hob by either method, making it easy for the user to try out both on his work and select the better. See Figs. 18 and 19.

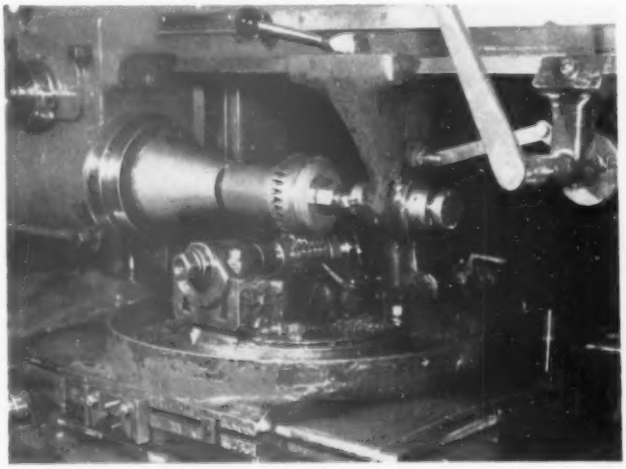
Climb hobbing may be performed in two ways.

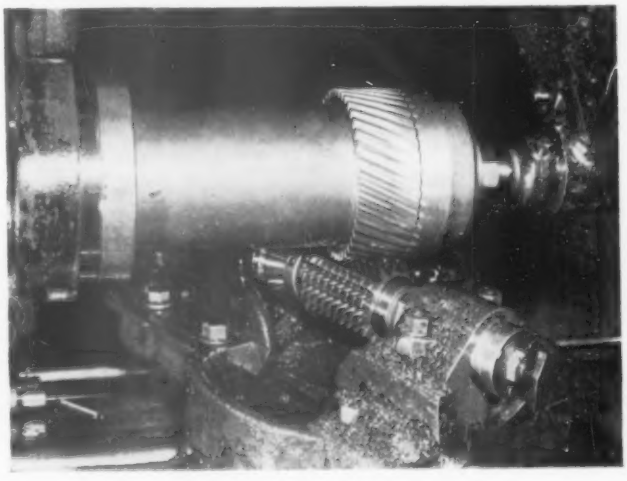
1. Reverse direction of feed leaving hob rotation the same as for conventional.

2. Reverse direction of hob rotation, leaving feed direction the same as for conventional.

However, machine tool builders should be consulted before making such changes, as reversal of certain shafts may sometimes be inadvisable without correctional features.

We have briefly tried to cover the highlights of the hobbing process involving such factors as the design and construction of the machine, description and explanation of the cutting tool, factors involved in obtaining precision and production, with various types of tooling or work holding equipment mentioned. An opportunity has been furnished to familiarize the reader with the types of work which can





Left, FIG. 17, showing conventional and climb hobbing. Above, FIG. 18; below, FIG. 19.

be produced by the hobbing process, and to show the various forms and shapes which may be cut.

Some of these operations are comparatively simple and some are highly specialized, but the hobbing process in general, by view of its universal application to repetitive forms, requires in each individual case a special examination of the job factors and variations in set-up to suit.

These comments have, of necessity, been only general in nature, but it is hoped they may serve as a guide in evaluating the hobbing method as a process for gear manufacturing.

Gear Lapping

by Charles R. Staub

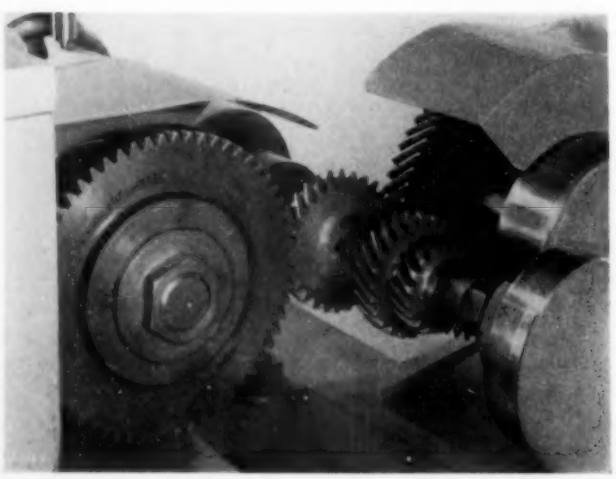
So long as gears have to be hardened a certain amount of distortion will always be present. In this regard engineering and metallurgy have not as yet reached the stage of perfection, although great strides have been made in reducing the amount of movement in steel during the hardening process.

Mr. Staub **was introduced to our readers in the February issue, *The Tool Engineer*, with an article on Cross Axis Gear Shaving. In this, the concluding article on gear finishing at Michigan Tool Company, he discusses Gear Lapping.**

It was found necessary therefore, to devise some means by which such errors can be corrected. The result was the development of the modern gear lapping machine. Some people are still of the opinion that lapping is a cure-all for every gear ill, which is a misconception of the process. It will only correct errors of reasonable proportion in tooth profile, spacing and lead. It will give the gear teeth a smooth finish, thereby improving the sound of the gears when assembled and running.

Ground gears are usually lapped after grinding. By doing this, the small ridges left by the grinding wheels are smoothed out, and the minute decarburized surface caused by grinding is removed, giving the gears a more mellow tone. Before the advent of the modern gear lapping machine, the method used was to lap gears together in pairs. In reality this is only a running in process, and the gears thereafter had to be kept in pairs as matched by "lapping."

FIG. 1.



There are several different types of modern gear lappers in use today, including the single and the double spindle types. The double spindle is the more effective and efficient of the two because it affords better all around control.

Fig. 1 shows a close-up of the two spindle type with two laps in mesh with the gear being lapped.

One of the requisites for efficient lapping is a fast reciprocating motion with a slow peripheral speed of the gear being lapped. The gear being lapped is mounted between centers and is driven by one of the laps which is hooked up directly to the driving motor, thereby driving through the work into another lap which is equipped with a brake that can be set for any desired amount of pressure. In the two lap method, one lap is set to run at an angle of from 3 to 5 degrees crossed axis with the gear being lapped. The driven lap is also set at a crossed axis angle of 3 to 5 degrees but to the opposite hand of the first lap. The resultant crossed axes with the gear provides effective lapping, when used in connection with the fast reciprocating motion of the lapping machine. The brake pressure should be set at not more than 75 to 100 pounds for best results.

Fig. 2 shows the contact of a 5 degree right hand lap with a gear tooth. Fig. 3 shows the contact of a 5 degree left hand lap with the gear tooth. The effectiveness of the crossed axis principle can readily be seen.

The reason for better control of the double spindle method is that the laps prevent the gear being lapped from accelerating or decelerating as the result of errors in the gear. Thus, if one lap is in mesh with the gear at a point where there are "plus" errors, while the other lap is in mesh where the errors are "minus" or zero, a greater lapping pressure will be exerted at this "point of error." This will cause faster lapping action to remove the error instead of the gear following through without any resistance.

Another decided advantage of the double lapping method is the ease with which a gear can be crowned. This is accomplished by setting one lap off angle in one direction and another lap off angle in the opposite direction, thus lapping across the corners of the gear teeth.

It is possible to crown gear teeth by this method, after gears are hardened if the amount of crown desired is not excessive. It is also very advantageous to use this method to lap gears that have been curve-shaved and hardened as the contour and shape of the crowned tooth can be maintained and refined at the same time.

Time required to lap the average run of gears is from one-half minute to two minutes per side of gear tooth.* If it takes much longer than this it is an indication that the gears are not coming to the lapping operation with reason-

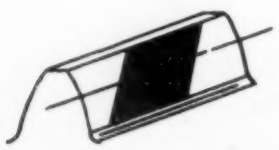


FIG. 2, above.

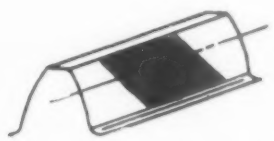


FIG. 3, above.

Below, from left to right, FIGS. 4 to 8.

able close tolerances. In such case, the cause should be investigated, instead of trying to eliminate all of the trouble by lapping. In trying to correct excessive errors by lapping through long cycles, the chances are that the gears will become worse instead of better, due to excessive wear on the laps. Laps eventually wear on the laps. Laps eventually wear to the average error in the gear being lapped.

Another good point to bring out here is that the use of too much lapping compound is as detrimental as lapping through too long a cycle. It is better to brush the compound on rather than flow it on with a pump. When the laps become worn, lap teeth can be turned off and a different number of teeth cut in the same blank, thus keeping lap cost to a minimum.

Figs. 4 to 8 inclusive show desirable bearings as well as erroneous bearings which sometimes appear on gear teeth and how to correct for each. The best bearing between the teeth of two mating gears is shown in Fig. 4. It consists of a full bearing on the face of the tooth. When teeth are not parallel to the axis of the gear (as in spur gears) and when the helix angle is not correct (on helical gears), the type of bearing shown in Fig. 5 is produced. This is also sometimes caused by hardening distortion. Unless distortion is excessive such bearings may be straightened by lapping.

The type of bearing shown in Fig. 5 is sometimes also produced under heavy torque loads on gears which, under light loads, would present a normal bearing. This is due to shaft deflection. Where such misalignment occurs, or where there is a chance that shafts will not be perfectly paralles, the type of bearing shown in Fig. 6 presents definite advantages. Heavy at the center, and fading out toward the ends of the teeth, the bearing will insure quietness under such conditions. It may be obtained by setting one lap "plus" on a 2-lap lapper, and the other lap "minus." Adjustable lap spindles are required to obtain this type of bearing.

Figs. 7 and 8 illustrate high and low bearing on gear teeth. To correct for a high bearing one of the laps should be withdrawn sufficiently to cause lapping action mainly toward the top of the tooth, leaving the second lap on proper center distance. The condition shown in Fig. 8—a low—bearing may be more easily corrected by lapping the mating gear than the gear showing the low bearing. This correction should be similar to that for a "high" bearing on the mating gear, since lapping the latter toward the top will bring the bearing down the desired amount.

Fig. 9 is a close-up of the lap heads which are also equipped with a pressure brake. Fig. 10 shows a close-up of a large herringbone gear being lapped on the large machine. Both of the 2-lap models are particularly suitable for this type of work. Both sides of the herringbone gears can be lapped in one cycle by having one lap in mesh with the one side and the other lap engaging the other side. Another desirable feature which is incorporated in all efficient lapping machines is that the direction of rotation is reversed at the end of each half cycle.

Since the development of the crossed axis method of finishing gears some twenty years ago, and its application to both gear finishing and lapping, much has been learned about gear production control. These processes today present the most economical and fastest methods available for obtaining—consistently—gears of high accuracy and smooth finish, for quieter operation and long life.

**Gears of coarse pitches and of larger diameters can be lapped as long as twenty minutes per side of gear teeth without fear of spoiling them, providing good judgment is used as to the amount of pressure applied and the amount of compound used.*

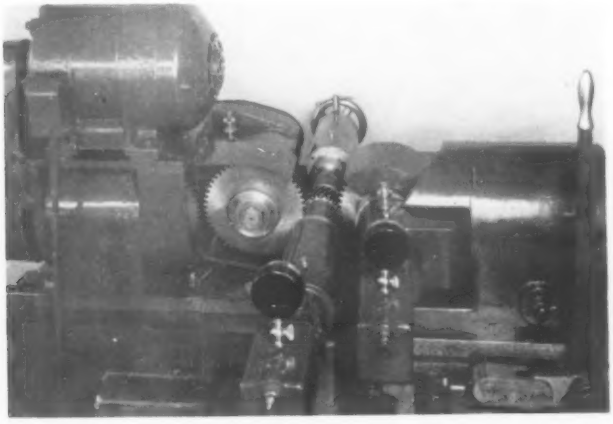


FIG. 9, above.

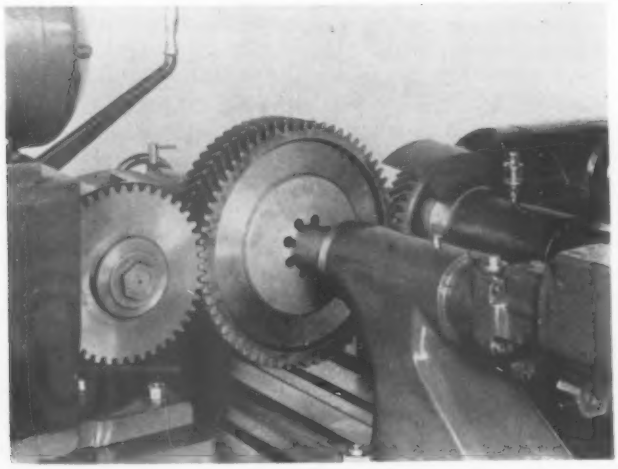


FIG. 10, below.

This Symposium on gears, perhaps one of the most complete ever published, has aroused great interest among our readers and throughout industry. Articles on Gear Finishing and Testing will follow in the April issue, *The Tool Engineer*.

New Non-Deforming Die Steel

The Carpenter Steel Co., Reading, Pa., announces a new air-hardening **NON-DEFORMING DIE STEEL,** called Vega, which combines the deep hardening characteristics of air-hardening steel with the low temperature heat treatment possible with oil-hardening steels. In an 8-inch diameter, for example, this patented steel has a hardness value from surface to center of C-60 Rockwell. It can be heat treated from a temperature 200°F. lower than is usually required for 5% chromium air-hardening steels. As shown in the figure, it expands only .0005" per inch of length and, upon drawing at 400° F., will return to within .00025" of its original size. One of the easiest air-hardening steels to machine; it is ideal for tools used in blanking, piercing, trimming or forming sheet metal; and it should prove useful to small and large users of better quality tools.

By E. A. Cyrol

The Rights and Wrongs of Wage Incentive Plans

Cooperation between management, engineering, foremen and workers are necessary for successful plant operation

MUCH HAS BEEN SAID and written about incentive wage payment plans, and it may be presumptuous to indicate that one has something worthwhile to add. However, the writer will attempt to tell about some of the pitfalls of incentives and to outline practices which may be of help in avoiding them.

To begin with, the industrial engineer must concern himself with the general management picture more than ever before, because, the incentive plan can go wrong in many places outside of the Industrial Engineering Department. Indeed, he should survey all of the functions of the plan, and point out to management any inherent weaknesses. Also, he should strive to bring about a greater understanding between the different levels of management and labor on the question of wage incentive pay.

E. A. Cyrol **is a consulting engineer with McKinsey, Kearney & Co., Management Consultants. A graduate of the College of Engineering, University of Michigan, he gained practical experience with Murray Corp'n of America and with Packard Motor Car Co., Aircraft Division. He is a member of Detroit Chapter, A.S.T.E.**

This discussion, pointed at the industrial engineer who is part of management and not a time study technician, is based upon:

1. The requirements of a good incentive wage payment plan. This is to give us a line of reference for our discussion.

2. The industrial engineer's part in the installation and maintenance of the incentive plan. We must consider his responsibility to management as a professional man.

3. The part that management has in the installation and administration of the plan. That part is a vital one and, too often, is not fully discussed when incentive plans are considered.

4. Labor's attitude toward this form of wage payment. Certainly the worker's reaction must be studied carefully because, as a participant in the incentive plan, he must be receptive to it. The incentive plan may go wrong anywhere along one of these four roads. To proceed then, what makes a good incentive wage payment plan?

Production Standards Essential

The first requirement of an incentive plan is a good production standard, but a production standard is good only if it is established and used under standard conditions. It does not matter how well a time study is taken, or how good the time study technique may be since, if changes occur and production standards remain as they were when the time study was taken, the standards are meaningless.

In attempting to define standard conditions, however, and to establish allowances in a plant or department, management too often neither recognizes unavoidable delays in the plant nor takes the necessary steps to correct them. Failure to remove delays, or to allow for them, quickly brings on worker's dissatisfaction.

Specifically, control must be exercised over: 1. Job conditions; 2. Quality of: a) the raw material; b) the finished product; 3. Methods, as pertaining to: a) machine speeds and feeds; b) tool layouts; 4. Material specifications.

Hourly Rates Should Be Guaranteed

For an incentive wage plan to operate successfully, hourly base rates for incentive workers, equal to hourly base rates for like jobs should be guaranteed. If the base wage structure is good, average hourly earnings—or any related average earnings—need not be guaranteed to any degree and, as a matter of fact, should not be guaranteed.

Possible incentive earnings must be large enough to spur the workers to produce to their full capacity. Suggested bonus allowances vary from 15 to 35 per cent; however, it is questionable whether a flat figure can be given. A foundry worker, for example, needs a greater incentive to keep him at a high production pace than a light bench assembler.

A clear-cut policy, specifying when a standard may be changed, must be established and rigidly adhered to. Much has been said about worker morale destroying wage cutting practices of the past; now, management must be doubly sure that all practices are above any suspicion in this direction.

A complete wage policy should be in existence. Such a policy should enable a worker to calculate his earnings without any particular difficulty. As for that, workers are pretty good calculators and keep detailed "bank books" of their "excess" earnings where loose *practice* allows it. However, a clear-cut, simple plan is required to show that there is nothing underhanded about the whole plan and that the worker is getting his full share for increased production.

Adjustment of Sub-standard Conditions

Any necessary temporary adjustment, in production standards, should be made by the time study engineer and not by the foreman or the time clerk. Under practical shop conditions some adjustments for sub-standard conditions are necessary; however, this adjusting should not be uncontrolled.

Finally, the plan must be constantly policed and maintained in good working order. Failure to fulfill this last requirement is responsible for more trouble than any other cause. Plans installed by outside engineering concerns very often get little maintenance after their installation if the necessary personnel is not trained to keep the plan in good working order.

Now, as to the industrial engineer's part in incentive wage payment plan maintenance. For, it is preferable that the installation of an incentive plan be made by a full-fledged industrial engineer—one who is able to determine: (1) whether the organization has the proper foundation for a sound incentive plan, and (2) the proper plan for the operations in which he is interested and the proper method of installing this plan. The operation of a good wage incentive plan requires good shop routings or operation sequence sheets, or tool layouts or by whatever name you may choose to call this data.

These routings must specify precisely what operations are to be performed; what machines are to be used for these operations; the tools required; the classification of labor, and enough description to insure that all requirements are met. The routings should also carry the production standards or prices. If such a routing is not available, it will be necessary to develop a new production standard each time that an operation is set up because, no two set-ups will be identical.

A Sound Foundation Held Necessary

A sound wage base structure is necessary. If such a base structure is not in existence, a job evaluation and proper classification is first necessary because, if there is any unbalance in the base wage at the outset, incentive earnings will tend to increase that unbalance. Also, a good production control scheme must be in existence. A production standard is not always equally applicable to extremely long or extremely short runs. Proper production control should insure a uniform flow through the shop. It is production control that keeps the shop running according to the routings mentioned before.

The Engineering Department must issue and maintain complete bills of materials. Whenever such a bill is not available, changes in assembly and design, and elimination of parts in the assembly often go by unnoticed and are not reflected in new production standards.

Accurate blueprints and specifications must be available. For, how can the time study man record the tolerances, finishes, the amount of welding, machining and so on to be done on a particular part if there is no blueprint? Lack of up-to-date blueprints often results in loose standards, because, the worker can then insist that the tolerances are more stringent than is actually the case.

Good set-up and job inspection sheets should be available. Often, a labor group attempts to force management into a practice that should have been adopted without any goading. One group put it this way: "After a job has been time studied, complete job instructions should be written out, including specifications regarding the necessary machines, tools, and materials. When the job is handed out, the employee should be given a card which contains the above information and the rate for the job."

Proper Tool Control a "Must"

Proper tool control is necessary because substituted tools require new standards. Also, before an incentive wage plan is installed, the engineer should determine if the job runs are of sufficient duration. If one operator runs more than three jobs per day, or if each job is of shorter duration than two hours per run, it may be inadvisable to install wage incentives. Under some conditions standard data may be used with good results on short runs.

The industrial engineer must be well grounded in all phases of management so as to be able to ascertain whether all the above functions are being correctly performed. If the engineer assigned to a wage incentive installation is overloaded in making the required study, he should have competent help.

The industrial engineer must also develop a policy to govern engineering procedures and to insure consistency in the administration of the wage plan. Of course, the philosophy of the wage policy must come from top management, but, the engineer must be capable of transmitting this philosophy on to a policy and practice for the Industrial Engineering Department. The wage policy referred to, here, should describe the type of incentive to be used.

We have discussed the requirements of a good incentive plan. The policy must also establish the basis of the production standards. Certainly this should be a thorough time study and standard data program. Past performances are absolutely untrustworthy because production standards established through the time study may be as much as 300% over past performance standards. The policy should indicate the technique of time study, and the observation methods which are to be utilized.

Industrial engineers often fail to utilize standard data because they claim that the construction of standard data is too time consuming. Perhaps so, but the consistency possible under standard data is worth any additional time that may be needed for this purpose.

The bases for the change of standards should be precisely described. Again, it is mentioned that management must guard against anything that resembles wage cutting. The wage policy should also describe the method of wage calculations. Some companies find it a morale builder to show the bonus earnings in separate figures on the pay check. In this way, the worker does not come to think of the entire amount as his expected earnings, instead, the base earnings and the gross earnings are shown as separate amounts to emphasize to the worker over and over again that the total consists of these two amounts.

Policy Should Be Clearly Defined

All expected questions as to permanent and temporary standards, and the procedure when a standard is questioned, should be answered as precisely as possible, also, the rules governing transfers of employees to new jobs with different base rates must be specifically indicated.

The industrial engineer must sell the incentive plan to the workers and keep it sold. The initial sale is probably the hardest, and, once sold, the industrial engineer must maintain the plan in good working order.

Who else contributes to the success or failure of an incentive plan? Well, top management has a heavy share in this. It must choose the proper personnel for the industrial engineering work—and here, it should be sufficient to say that the industrial engineer should be a full-fledged engineer by practice or by training.

Top management must learn what incentives are; what they can and cannot do; must develop a philosophy which would determine the industrial engineering policy practices. If top management does not stand behind these policies and practices, and give the Industrial Engineering Department full and understanding support, this department can not function successfully.

The middle management, composed of the director of personnel, the chief tool designer, the chief inspector, the chief engineer, and the superintendents also have an important share. This middle management must also understand the incentive plan—and, *there can be no understanding without knowledge.*

Foremen Must Cooperate

What about the lower management?—the foremen and group leaders who are the first in line to administer the wage incentive plan but who are usually the last in line to be told of its workings. Being close to the actual work, and being responsible for keeping their department operating, they are often harder to sell than the workers. For example: In a plant manufacturing precision instruments, when incentives were proposed, the foremen were quick to object on the basis that the required tolerances could not be held under the push of the bonus pay.

After they were sold, however, through long and patient discussions with examples of similar operations which were on incentives, they were enthusiastic participants in the installation and the plant realized 66% increase in production. If the work is repetitive, precision does not prevent the application of incentive pay.

The foreman must understand the incentive plan. The industrial engineer, in some cases, can subtly force the foreman to study the plan by requesting him to explain it to some visitor in the plant. If the foreman is not able to do so the first time, he will probably be prepared for the second time.

The foreman must be made to understand that it is his responsibility to administer the wage incentive plan; that it is not to be the problem of the Industrial Engineering Department, but his own. Finally, we must have the enthusiastic support of the labor group for successful operation of the incentive wage payment plan. Has management encouraged this enthusiastic support from labor through its recent application of the incentive plan?

Before wage incentives can be said to be accepted by the worker group, management and the industrial engineer must convince the worker that there can be higher wages only if they are accompanied by higher output per worker under our economy. This higher output must not come through greater physical toil, but rather through the technological improvement and the workers' cooperation in the utilization of this improvement. If labor and management is not agreed at the outset on the goal of incentive wage payment, there can be no understanding in the administration of such a plan.

Here are some conclusions to be drawn from our discussion: To begin with, a soundly conceived incentive must form the basis for any installation. And, the goal of the plan and the means whereby that goal is to be reached must be known by the entire organization. An industrial engineer must be capable of: (1) Determining whether the organization offers fertile ground for the incentive plan. (2) Putting a standard upon an operation and selling it and the necessary procedures of maintaining it to both management and labor.

Management in all its levels must understand the plan and support it. The organization using incentives must be relatively a better organization in the utilization of its procedures than the one that uses day work pay. Wage incentives may be thought of as a very specialized automatic feed equipment which can cut production costs if it is maintained properly and if it is attached to a good machine.

Both management and labor must become better informed about the workings and the goals of incentive wage payment through sharing of unbiased information. *There must be trust between management and the workers.* Unfortunately, however, cold analysis of present conditions does not indicate that the recent increase of the use of incentive wage payment plans has brought greater understanding of these plans or greater trust of management practices. There are still many incentive wage payment plans going wrong.

A CORRECTION

In the article, "The Use of the Diamond Pin in Locating Work," by Burton R. Garrett in the December issue, an unfortunate error occurred in the spacing of the vertical lines on the charts, page 33. The center to center distance of these lines must be closely held, and readers wishing to mount the charts on stiff board can easily correct them by the following method:

Using chart No. 3 (shown at right) as an example, call the left hand vertical line A, the intermediate B and the right hand line C. Also, call the distance between the extreme bottom and top figures (.3680 and .3820 on Chart 3) on line A, H. Measure this distance carefully on each chart and put down the figure to the nearest even dimension. For example, H on Chart 3, page 33 (December The Tool Engineer, scales $3\frac{13}{16}$ very nearly. Then, to ascertain the correct center distances:

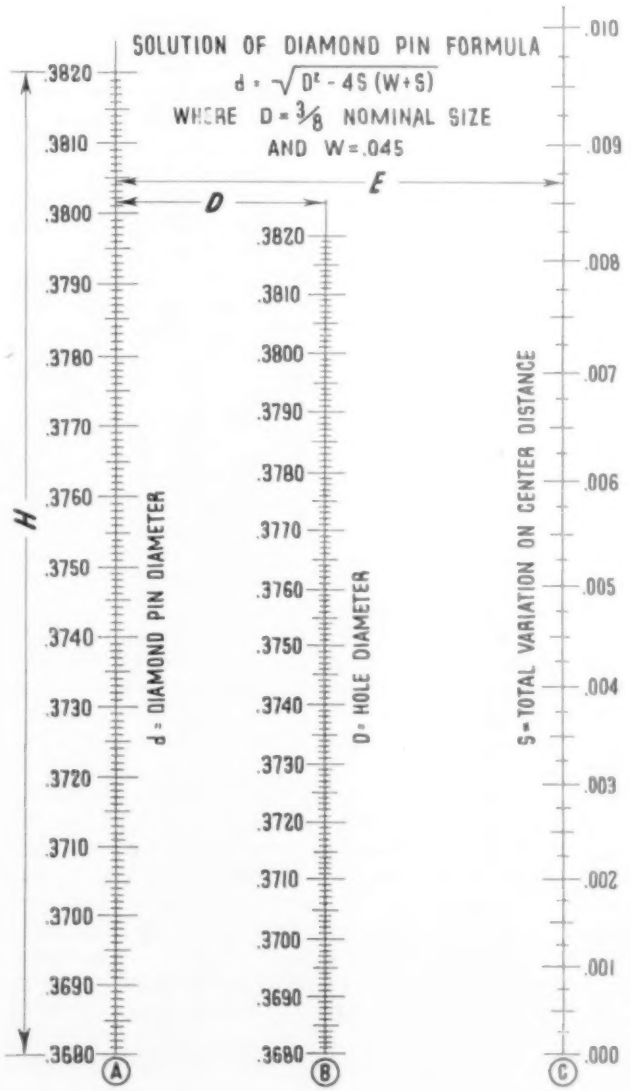
For Chart No. 1, D = H × 15.4 and E = H × 61.5
No. 2, D = H × 12.2 and E = H × 61.3
No. 3, D = H × 10.8 and E = H × 63.2
No. 4, D = H × 11.7 and E = H × 61.5
No. 5, D = H × 13.7 and E = H × 69.0
No. 6, D = H × 12.3 and E = H × 62.0

TABLE 1

Values of W *for Given Values of* D

D Hole Dia.	W Chord Length
$\frac{1}{8}$ to $\frac{11}{64}$	.020 +.000 −.003
$\frac{3}{16}$ to $\frac{19}{64}$	.030 +.000 −.003
$\frac{5}{16}$ to $\frac{27}{64}$	.045 +.000 −.004
$\frac{7}{16}$ to $\frac{35}{64}$	.070 +.000 −.004
$\frac{9}{16}$ to $\frac{3}{4}$	.095 +.000 −.004

Also, Table 1 (showing values of W for given values of D), was omitted. This is included above. We keenly regret these and other errors that, occasionally, have cropped up during the past year; however, changes have been effected which should obviate these in the future.



By C. D. Wright*

Calculation of Pin Measurement for Right and Oblique Cones

When measuring right and oblique cones in relation to each other, as in gages and tools, a pin or ball is usually—and advantageously—used. Determining the location of the measuring pin, however, involves several mathematical steps, and it is necessary to reason out all of these steps every time the problem comes up. This is especially true of oblique cones.

Solution by mathematical steps also involves a considerable resort to the trigonometric tables, with possibility of accumulated errors. By use of the formulas shown below, however, solution is reduced to a simple operation that can be done on a calculating machine, with but a single reference to tables.

FROM FIG. 1, given: d, r, $< a$, and $< b$, to find x
From diagram, $< ABC + < ABE + < EBH = 180°$
Where, $< ABC = 90° - < a$; $< EBH = 90° - < b$, and $< ABE = < e$
By substituting, $90° - < a + < e + 90° - < b = 180°$

$$\therefore < e = < a + < b \tag{1}$$

In $\triangle$ ABE, $\dfrac{AB}{\sin < AEB} = \dfrac{d}{\sin e}$ (law of sines)

Since $< AEB = 90° - < b$ $\therefore AB = \dfrac{d \sin (90° - < b)}{\sin e}$

and, since $\sin (90° - < b) = \cos b$ $\therefore AB = \dfrac{d \cos b}{\sin e}$ (2)

$< ABC + < ABO - < DOB = 90°$, where $< ABC = 90° - < a$

and $< ABO = < \dfrac{e}{2}$ and $< DOB = < c$

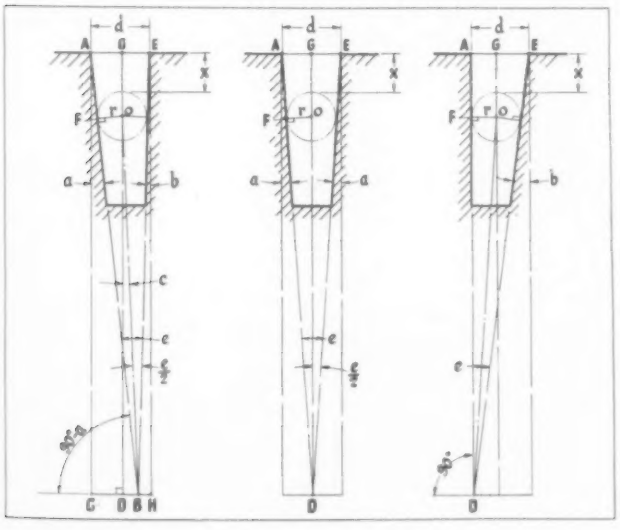
$$\therefore 90° - < a + < \frac{e}{2} - < c = 90°$$

$$< c = < \frac{e}{2} - < a \tag{3}$$

In $\triangle$ ACB, $AC = AB \cos a$. Since $AC = GD$,

$$GD = \frac{d \cos a \cos b}{\sin e} \tag{4}$$

*Mr. Wright is Chief Tool Engineer, The McKinnon Industries, Limited, St. Catharines, Ontario. He is a member of St. Catharines (Niagara District) Chapter, A.S.T.E.



In $\triangle$ OBF, $OB = \dfrac{r}{\sin \frac{e}{2}}$ (5)

In $\triangle$ OBD, $OD = OB \cos c$
Substituting value of OB in (5),

$$OD = \frac{r \cos c}{\sin \frac{e}{2}} \tag{6}$$

$$x = GD - OD - r \tag{7}$$

Substituting (4) and (6) in (7),

$$x = \frac{d \cos a \cos b}{\sin e} - \frac{r \cos c}{\sin \frac{e}{2}} - r$$

Substituting (1) and (3) for values of $< e$ and $< c$,

$$x = \frac{d \cos a \cos b}{\sin (a + b)} - \frac{r \cos\left(\frac{a + b}{2} - a\right)}{\sin\left(\frac{a + b}{2}\right)} - r \tag{8}$$

IN FIG. 2 $< a = < b$
Substituting $< a$ for $< b$ in (8)

$$x = \frac{d \cos a \cos a}{\sin (a + a)} - \frac{r \cos\left(\frac{a + a}{2} - a\right)}{\sin\left(\frac{a + a}{2}\right)} - r =$$

$$= \frac{d \cos^2 a}{\sin 2a} - \frac{r \cos O°}{\sin a} - r$$

$\sin 2a = 2 \sin a \cos a$, and $\cos O° = 1$
Substituting, $x = \dfrac{d \cos^2 a}{2 \sin a \cos a} - \dfrac{r}{\sin a} - r$

Since $\dfrac{\cos a}{\sin a} = \cot a = \dfrac{1}{\tan a}$,

$$\therefore x = \frac{d}{2 \tan a} - \frac{r}{\sin a} - r \tag{9}$$

IN FIG. 3 $< a = O°$
Substituting $< a = O°$ in (8),

$$x = \frac{d \cos O° \cos b}{\sin (O° + b)} - \frac{r \cos\left(\frac{O° + b}{2} - O°\right)}{\sin\left(\frac{O° + b}{2}\right)} - r =$$

$$= \frac{d \cos b}{\sin b} - \frac{r \cos \frac{b}{2}}{\sin \frac{b}{2}} - r$$

$$\text{or } x = \frac{d}{\tan b} - \frac{r}{\tan \frac{b}{2}} - r \tag{10}$$

EXAMPLE: Given $d = .4750$, $r = .21875$, $< a = 1° 46'$, and $< b = 2° 25'$. Calculate x.
Using (8),

$$x = \frac{.4750 \cos 1° 46' \cos 2° 25'}{\sin (1° 46' + 2° 25')} - \frac{.21875 \cos\left(\frac{1° 46' + 2° 25'}{2} - 1° 46'\right)}{\sin\left(\frac{1° 46' + 2° 25'}{2}\right)} -$$

$$- .21875 = \frac{.4750 \times .99952 \times .99911}{.07295} - \frac{.21875 \times .99998}{.03649} -$$

$$- .21875 = 6.5024 - 5.9947 - .21875 = .2990$$

$$x = .2990$$

Where $< a = < b$, use (9).
Where $< a = O°$, or $< b = O°$, use (10)

By Harold Lundstrom

Tooling the Tools for Precision Manufacture of Wobble Shaft

An article poignantly illustrating the point that, in precision manufacture, you sometimes "have to make the tools to make the tools that tool the job."

Background of the Problem

RAPID DEVELOPMENTS during the War have brought widespread attention to the subject of pumps, particularly high pressure pumps. In general, the designers of such pumps turn to piston types as being capable of higher pressures than rotary or centrifugal types. These piston pumps have three typical arrangements of pistons; the straight in-line, as for instance the arrangement of pistons and cylinders in a standard 6-cylinder automobile engine; the radial arrangement, such as is common to the radial aircraft engine used so widely in this country and lastly, the type where the pistons are parallel to one another, but arranged in a circular group. A schematic drawing of such a piston arrangement is shown here. Fig. 1.

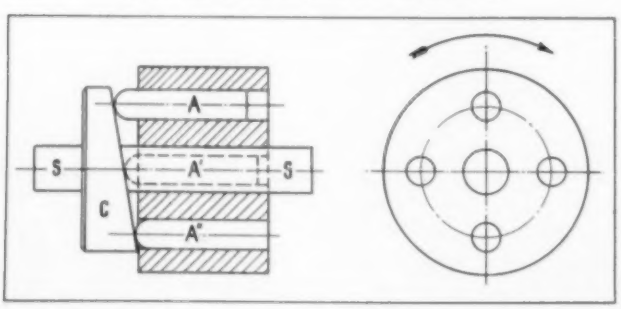
***Harold Lundstrom*, chief engineer of W. N. Nichols and Sons, is a natural *tool engineer*, who, with 37 years experience in the development of methods, and tools, has "accumulated" a vast store of "know-how." He tooled fixtures for the Liberty engine in World War I, and the Rayon metering pump, famous for its quarter-tenth tolerances. He also designed ultra-fine tools used in the recent war.**

As shaft S revolves, carrying cam C, the plunger A (which cannot be carried with the shaft because of being closely fitted to a stationary housing) moves to the right through position A, "to full stroke, A," thus ejecting fluid from the cylinder. This type of pump is quite compact and is deservedly popular. Since this is so, there may be many tool engineers faced—as we were a few months ago—with the problems of producing in quantity the wobble shaft or cam for such a mechanism. The following explanation of a successful solution to that tooling problem is offered in the hope that the general method or some of its details may be helpful. This process and tools have been in production with outstanding results.

Development of Operation Sequence

We tackled the problem *Yankee fashion* by going on with our work, letting the wobble shaft slowly infiltrate until we arrived home that night. Then, with our shoes off, and our father-in-law's pipe drawing well, we started to analyze, sifting out the standard operations, arranging the basic geometry in our minds, and evolving a scheme for the tooling framework. Next day, we roughed out sketches of the master angular fixtures, revised them and, well on our way, laid out an operation sequence to suit, as shown in Fig. 2. The simplified drawing of the wobble shaft to be produced is shown as Fig. 3.

FIG. 1. Simplified diagram of Wobble Pump.



Highlights of Machining Operations

The basic idea which governed the tooling and sequence of operations was that the part, before hardening, was to be within .005" of finished sizes so that grinding and lapping would be held to a minimum. This method called for accurate control of dimensions early in the routine, but was felt to be necessary because we had a minimum of grinding equipment available. Several dimensions depended a great deal on the finish allowances of other dimensions. Also, the extreme surface hardness we were after would be secured only if we ground a very minimum from each surface after case hardening. As a general basis for tooling any job, we feel that this idea is sound and avoids a great deal of confusion.

Skimming through the main operations, these are the points of interest:

(A) Notice that, by chucking the blank ¼" off center in Operation No. 20, size of the required bar stock was reduced ⅜" in diameter, effecting a real saving in cost of the part.

FIG. 2. Operation sheet for manufacture.

Oper. No.	*Operation Name*
10	Cut off bar stock
20	Rough turn and face stem (first side) off center ¼"
25	Face and rough turn O.D., rough turn chamfer, rough bore (second side) holding by the stem
30	Face (second side) to length, turn angle diameters, tap $1\frac{1}{16}$-16
40	Face first side to length, turn diameters, undercut and chamfer
50	Shape internal teeth
60	Drill, ream and countersink .251" hole in line with tooth space
72	Turn and face angular diameter (first side) turn snap ring groove, undercut and chamfer
82	Drill 2 angular oil holes .094
92	Drill 2 connecting oil holes
102	Mill notch
112	Mill slot
122	Mill oil grooves—bottom face
125	Mill oil grooves—top face
126	Clean
130	Inspect
140	Heat treat
142	Sandblast
150	Grind bottom face
155	Finish lap bottom face 8 M.I.R.M.S. finish
157	Rough grind 2.9990-3.002 dia.
160	Finish grind 2.9960-2.9955 dia.
163	Rough grind hub face to length
165	Finish grind hub face to length
167	Rough grind 1.1855-1.1850 dia. and rough grind angular face to 1.376
170	Finish grind angular face to 1.375-1.373 and finish grind 1.1855-1.1850 dia.
178	Wash-spirits
200	Final inspect

(B) The first locating point crops up in Operation 30, where the large diameter is held to .0005" variation to suit later shuttle operations. This setup includes an $^{11}/_{16}$"-16 tapping in the bottom of the central hole to be used solely as a convenience in later work holding fixtures. The designers readily agreed to adding the tapping, since the hole had to be there for lightness in any case.

(C) Operation 40 is for the purpose of finishing several unimportant surfaces, and provide for an accurate face and diameter for the gear shaper work to follow. This is the first operation when the above $^{11}/_{16}$"-16 tapping is used—in this instance as a means of pulling the part back into a seat bored in place on the faceplate. This method of holding on the gear shaper insures concentricity of the large diameter with the smaller stem. This concentricity is necessary to secure true running of the gear shaped teeth with the large bearing diameter.

(D) This particular wobble shaft is part of an injecting device where accurate timing of injection is required; therefore, there must be some means of locating the high spot of the cam without searching for it. This the designers did by providing a drilled and reamed register hole, "H," the centerline of which lies in the same plane as the centerline of the wobble shaft and the centerline of the angular stem. Further, one of the gear shaped tooth spaces must be located in the above plane. This feature involves all of the major tooling from Operation 60 on. The gear teeth are cut at random, since the stem has not yet been turned on its final centerline. Following cutting, the part is jigged by the large diameter and face, a blade is slid into that tooth space which most nearly matches the Operation 20 eccentricity, and the .251" diameter register hole is spotted, drilled and reamed. All later work shuttles use this hole as a locating point, insuring final agreement between the various centerlines of work, stem and register hole.

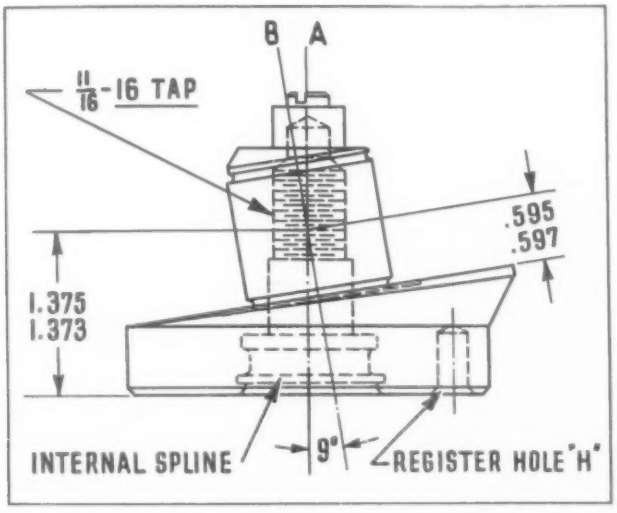


FIG. 3. Important dimensions of Wobble Shaft.

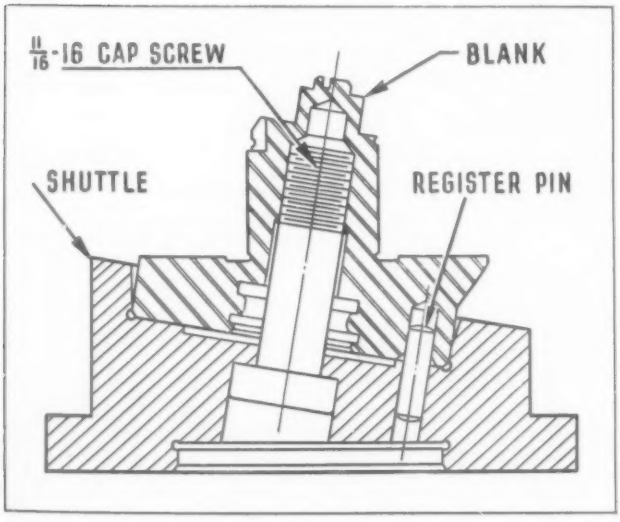


FIG. 4. Shuttle and work blank assembled.

The Shuttle System

(E) For Operation 72 (turn and face angular stem diameter) the first of the angular shuttles comes into play. The shuttle is shown in Fig. 4, and is used by seating the work in the shuttle, holding back with the central $^{11}/_{16}$"-16 cap screw, then mounting the shuttle on a ground-in-place large pin in the turret lathe spindle, clamping against the faceplate. (The method of making these shuttles is simple and unique and is described later on in the story.) Two shuttles are provided so that the operator may load while the lathe cuts.

(F) After heat treat, the final surfaces are produced, starting with the large flat face, which is first ground in a simple block fixture on a surface grinder, using an indicator height gage to insure equal stock removal from all quadrants. (A simple but effective gaging system for establishing heights of angular surfaces is used here, and this system is also described later on.) The grinding is preparatory to lapping the same surface on a Norton No. 2F. Purpose of the lapping is to secure the smooth bearing surface required for high bearing pressures usually encountered in this type of pump. The lapping is practical since the material used (heat treated and case hardened SAE 4140) provides a surface hardness of Rc 63 to Rc 64. Fine finish is therefore possible, and an 8 R.M.S. surface roughness reading is usual.

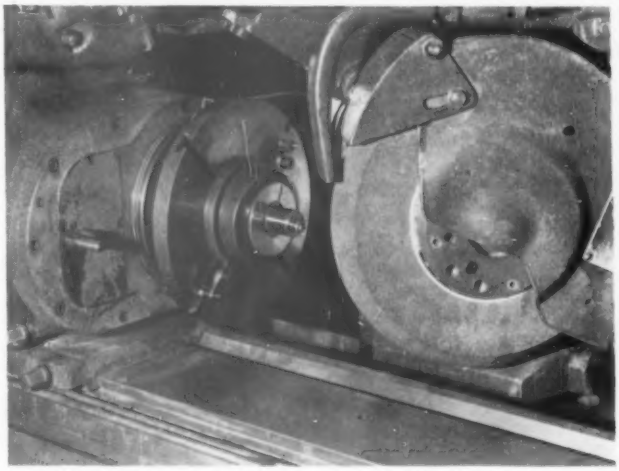
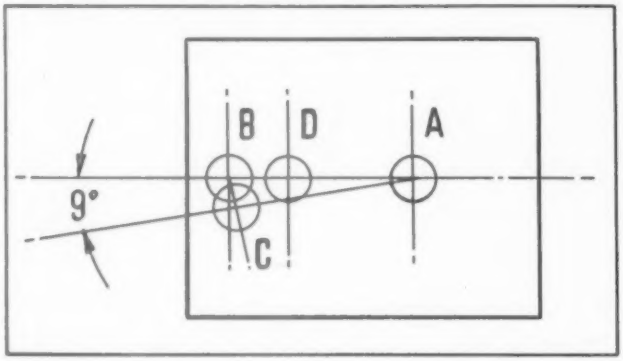


FIG. 5, above; FIG. 6, below.



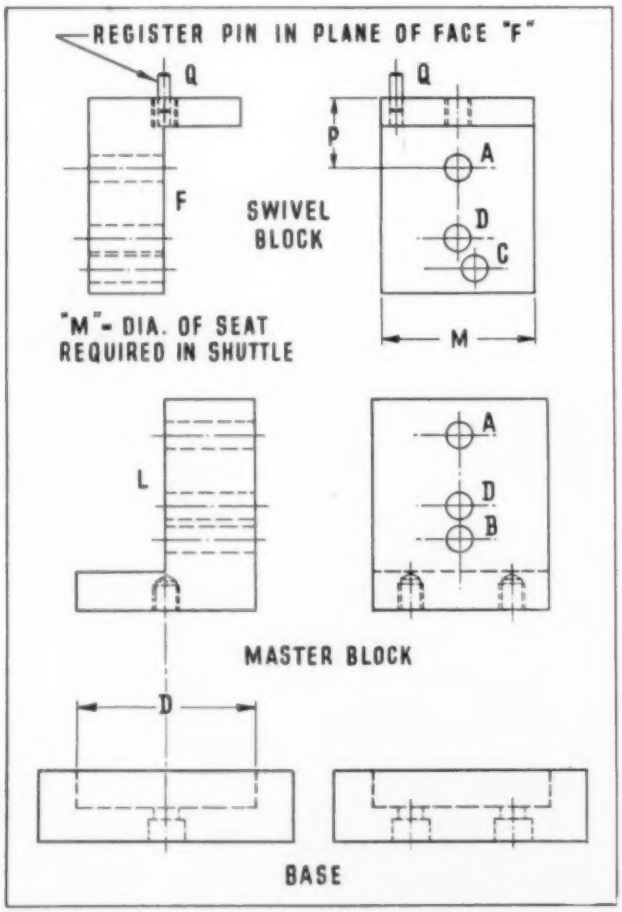
(G) To grind the large diameter to a finish, two handlings are involved. The work is pulled back against its lapped flat face, locating on a pin which allows a small "float" so that the diameter to be ground may be rapped true before grinding. Here again, a fine bearing surface must be developed, and hence the double grind, Operations 157 and 160.

(H) Operations 167 and 170, rough and finish grind, angular face to length, make use of the shuttles (before mentioned, and yet to be described) in order to establish the angular relationship between the two faces. These grinds are done on a hydraulic Universal Grinder so that the periphery of the wheel may be used, thus producing a round-and-round surface finish, necessary for best pump performance. The wheelhead is swung around so that the plane of the wheel is 45° to the table motion, and the wheel faced trued at 90° to the table motion. No tailstock support is used, as the work is pulled back with a draw bolt into the shuttle seat, the shuttle being held back with dogs to the faceplate. This setup is illustrated in the photograph, Fig. 5. The stem diameter is finished at the same time, using the same shuttle setup, and a portion of the wheel rim trued parallel to the table motion. Obviously, the procedure is quite simple, depending on master fixtures for reproducing their accuracy in the work pieces. A description of the method of making these master fixtures follows, and may be of considerable interest to others who have the problem of producing angular fixtures, but who for one reason or another do not use sine bars.

How to Tool for the Angle

The basic idea we used was that of producing the required angle by means of the jig borer, whose inherent accuracy could thus be used to good advantage. The jig borer's stock in trade is its ability to bore holes exactly where wanted.

FIG. 7a. A—Master fixture.



A simple layout, Fig. 6, was made showing the linear dimensions between four holes, A, B, C, D, arranged so that the angle between the two centerlines BDA and CA is exactly the angle required between the two finished faces of the wobble shaft. These holes were so located on the diagram that the distance AC exactly equalled the distance AB, for reasons to develop later. Now, a master fixture for making the shuttles was laid out, using these dimensions, the fixture taking the form shown in the diagram, Fig. 7A.

This fixture consists of five parts; a base, a master block, and three swivel blocks of assorted nose diameters and lengths, each adapted to one particular shuttle, whether for rough or finish turning, or for grinding. The base is a cast iron ring arranged so that it may be indicated dead true on the lathe or grinder faceplate. The master block is secured to the true bore of the base by two cap screws shown at QQ in Fig. 7A. The master block is in the form of a cylinder which has been milled away along an axial plane for three-quarters of its length, leaving a flat central surface into which the three holes A, D, and B are accurately spaced and bored.

The swivel blocks are also cast iron, and resemble the master block except that the layout of holes in the flat face is different being A, D, and C as shown in Fig. 7A. Diameter M is also made to agree with the diameter of the wobble shaft base for the particular operation the shuttle is being made for. Distance P is likewise made precisely as required, to bring the intersection of the wobble shaft centerlines to the point desired—in other words, allowance for finish grinding material on the base of the wobble shaft is made here in dimension P. *Important:* Both the diameter "M" and the length P must be turned and faced only when attached to master block with a closely fitted dowel through pivot holes A and reference holes D. Fig. 7B. Also important—planes L and F must include the centerline of your lathe or grinder spindle rotation, a relation easily brought about if care is used in making the master block flat face.

The shuttle blanks, which may be cast iron or hardened steel, are now prepared and the seat into which the wobble shaft will mount, carefully finished in these blanks. Next, the shuttle is attached to the nose of the swivel block,

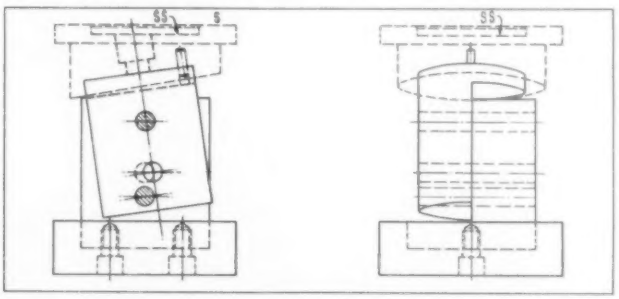
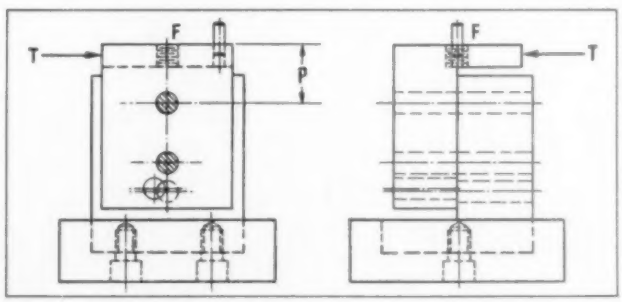


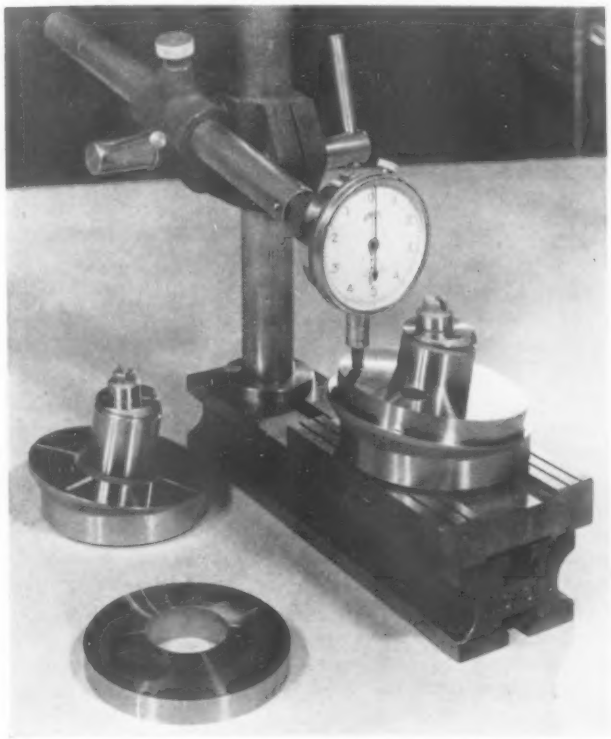
FIG. 7b. Fixture as assembled for turning dia. T and facing F to dimension P.

FIG. 7c. Fixture as assembled for finishing shuttle base at S and SS.



locating by diameter M and register pin Q, holding with a cap screw into the tapped central hole. Now, we remove the reference dowel from hole D, swing the shuttle and swivel block until holes C and B line up, and redowel. The dowels, of course, are nutted both ends so that they act as bolts. Now, the shuttle base may be faced or ground, and a diameter finished for nesting in the production machine.

FIG. 8.



Note that any shuttle so made will surely produce (a) the angle established by the checkable jig bored holes, and (b) the centerline intersection point "P" inches above the work base—the two vital dimensions required in the wobble shaft.

How to Production Check the Angle

Checking angles in production is always an interesting problem, and usually runs into complicated tools. The simple solution we worked out and adopted has been quite satisfactory, yet durable. This checking device consists of a hard ground ring whose bore fits the stem of the work piece, with a back face lapped flat to seat on the angular surface of the wobble shaft, and a front face conical ground on a Heald rotary surface grinder to the exact angle needed.

This angle was verified by using a surface plate, a right angle block, two .4060" diameter lapped straight pins, and a little trigonometry. The finish ring is shown in the foreground of photo Fig. 8. In use, the wobble shaft is placed base down on a lapped surface, the checking ring seated against the angular face, and an indicator height gage used to run along the topmost element of the cone surface to see that it is parallel to the surface plate, thus checking the angle. This setup is shown in Fig. 8. The actual height gage setting above the surface plate may be used to verify the thickness of the wobble shaft base and intersection height. See Fig. 3.

Conclusions

The principle of using the jig borer to produce accurate angles has proved in this instance to be satisfactory, and has the further advantage that the work of the jig borer may be readily checked by the use of plugs and blocks on the master fixture.

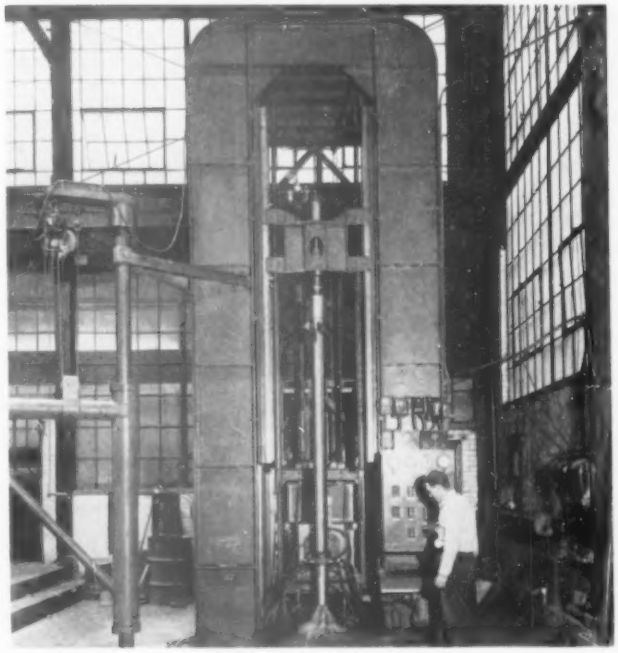
The principle of careful blank preparation leaving .005" stock allowance for finish grinding is economical in volume production, and effects maximum surface hardness in the product. This principle may be followed only by basic soundness and directness of tooling.

Surface Hardening Large Piston Rods

SERVICE FAILURES of piston rods start on the surface of the rod, usually at some stress raising point such as a tool mark, nick, groove, or at a misfit between rod and ram. The failure progresses from the surface inwardly until a section of the rod is so decreased that it can no longer resist the direct stresses encountered in service.

After two years of research and experimental work, *Heppenstall Co.*, Pittsburgh, Pa., developed the following method: A heat-treated, completely finished and ground piston rod, suitably preheated, is inserted in a specially constructed machine. A water-cooled induction heating unit is slipped around the tapered end of the ram, and the rod revolved at a speed commensurate with its size and the desired heating rate. A pass is then made with the induction heating ring and quench spray.

The rod surface is raised to approximately 1600 degrees F. and is progressively hardened on the surface by the immediate impingement of a traveling cold water spray attached directly beneath the induction ring. A typical rod, so hardened, will show a hardness through the cross-section of 495 BHN on the surface, 302 at a depth of ¼", 295 at ¾", and 285 at the center. As an example of improved service, a 10" conventional rod averaged 210 working hours in a 35,000 lb. hammer, while an induction surface-hardened rod served for 598 hours.



By O. W. Winter

Tool Engineering—A Profession

Growing recognition of a vital branch in engineering makes degree courses in Tool Engineering a "must"

During the past thirty years, there has been developing, in America, a new and involved engineering science which, directed to the tools and methods for mass production, has come to be known as tool engineering. That industry has been quick to recognize its development is borne out by the number of men in industry who, in some form or other, bear the title "Tool Engineer."

Likewise, the existence of tool engineering departments, embracing the functions, equipment selection, production planning, tool design and tool making, maintenance and so on, further attests to the vital functions and work covered by the title.

Otto W. Winter **is vice-president of Acme Pattern & Machine Co., Buffalo, N. Y. For several years a Director of the A.S.T.E., and a past President, he has served the Society for the past several years as Chairman of the Educational Committee. In this article, he presents the case for degree courses in Tool Engineering.**

As a result, there is growing throughout America—and throughout the world, for that matter—a keen awareness of this new and distinct branch of the engineering profession. Especially is this true in American industry and education, as brought out by a recent survey, conducted by the American Society of Tool Engineers. Out of replies from almost a thousand leading industrialists and engineers, 98 per cent expressed a confirming opinion of the foregoing statement.

Education Has Lagged

Characteristically enough, education has lagged far behind industry. This, however, is a mutual indictment of both. It is bad enough that education persists in being out of step with industrial requirements and developments, but the fact that industrial leaders do little about it merits no excuse. There is every indication, however, that something is going to be done about the matter and that an unprecedented cooperative effort will result in the long neglected recognition of this profession.

As a rule, Tool Engineers in the past have been self-made men, a condition brought about because the engineering schools in the country have had nothing to offer in this field. Alert schools, however, are becoming increasingly aware of this shortcoming and are doing something about it. Unfortunately, the allotted space for this article does not permit a detailed report, but the situation bears watching and merits encouragement. In the aforementioned industry survey, for example, it was unanimously agreed that Tool Engineering should be taught as a college degree course and that a great amount of precious time could have been saved in the typical self-made careers of most Tool Engineers had they been able to study the subject in concentrated form and presented by modern scientific teaching methods at a collegiate level.

The misconception of most educators as to what this subject involves is rather appalling, but it is not surprising and necessitates a great deal of enlightenment on the part of A.S.T.E.'s Education Committee and others as well. Another factor to be reckoned with is the general thinking of the Engineering Council for Professional Development and of many educators that an engineering education should include more broadening subjects and more of the human qualities necessary to make a better citizen as well as a superior engineer.

Progressive Schools Solve Problem

Progressive degree schools—as, for example, Ohio State University—have solved the problem, without lowering the technical content of engineering courses, by making engineering a five-year instead of a four-year course. And certainly, if a good citizen and broad individual, as well as an embryo engineer, is to be turned out, with adequate training and education to enable him to be of some value to industry upon graduation, more than four years training is necessary.

Questions such as whether Tool Engineering has sufficient scientific value to warrant a degree course can, in one way, be answered by comparing it with Industrial Engineering, in which many universities offer engineering degrees. Tool Engineering is, in a sense, Industrial Engineering with many of the courses in management, labor problems, accounting, production control, and so on replaced by Tool Engineering courses which, in effect, makes such a course more technical and scientific than ever before.

Another way of looking at it is that Tool Engineering is Mechanical Engineering minus a lot of the steam laboratory, heat power, internal combustion engineering and like courses that characterizes most Mechanical Engineering curriculae. These, in turn, are replaced by practical Tool Engineering courses to give an engineer something to work with in his eventual role after graduation.

Another popular misconception of Tool Engineering, and its degree rating, lies in a feeling that Tool Engineering courses are vocational rather than professional or engineering in nature. Such opinion is only born of ignorance of what the subject actually consists of, which, in turn, is primarily brought about by lack of experience and lack of contact with industrial practice. Technically speaking, Tool Engineering can be considered as consisting of ten basic subjects—seven primary and three related. The primary subjects are those which a Tool Engineer should understand in their entirety and the related three are those in which he should be versed to a degree that will enable him to apply such knowledge to Tool Engineering problems without necessarily being expert in any one of the three fields. The subjects are as follows:

Primary Tool Engineering Subjects

1. *Machine Shop Practice and Cutting Tool Design.* Includes Machine Tool Design and Application, Science of Metal Cutting and the more advanced aspects of Machine Shop Practice.

2. *Jig, Fixture and Gage Design and Practice,* as related primarily to machine shop and assembly operations.

3. *Sheet Metal Work and Die Design,* covering all types of sheet metal fabrication.

4. *Forging Practice and Die Design*, covering all types of hot and cold forging, upsetting, extrusion, and so on, with particular reference to equipment and tooling.

5. *Permanent Molding, Plastics and Die Castings*, with particular reference to equipment and dies as well as secondary operations.

6. *Welding Methods and Equipment*. This should include special reference to machine welding such as spot, butt, flash, seam, projections, and so on. Arc and oxy-acetylene welding and studies primarily in connection with machine and tool applications likewise flame cutting and flame hardening.

7. *Manufacturing Analysis*. A complete yet specific Tool Engineering subject embracing the fundamentals and essential parts of cost accounting, work routing and planning, operation analysis, time and motion study, etc. The subject as approached by the Tool Engineer to find in monetary as well as practical values the best way to do the job.

Related Tool Engineering Subjects

These must be understood by the Tool Engineer, but only in part:

1. *Metallurgy and Heat Treating*—enough to select materials for Tools and Equipment, plan heat treating operations and understand metal cutting, forging and forming.

2. *Foundry Practice and Pattern Making*. A specialized subject not involving tooling as such to a great extent, nevertheless must be generally understood by the Tool Engineer.

3. *Machine Design and Applied Mechanics*. While usually considered two separate subjects can however be combined for the purpose of the Tool Engineer. Fundamentals and phases applicable to tool and special production machine design should be covered.

Knowledge of Basic Sciences Essential

In order to comprehend and apply these subjects on an engineering level (which modern manufacturing practice necessitates) the Tool Engineer should have a thorough grounding in the basic sciences of mathematics through calculus, physics, mechanics, chemistry—an amount equivalent to that given degree courses in Mechanical Engineering. No less.

What is needed is an understanding of the subject of Tool Engineering, on an engineering level, by engineering college faculty. It is significant that, in the aforementioned industry survey, 98 per cent of those answering felt that present college faculty was incompetent to teach Tool Engineering and that new talent would have to be employed. The discovery of such talent will not be easy because, not only must one have the practical concept of Tool Engineering but also a comprehensive grasp of the subject, on an engineering level, to be able to teach it; also, one must be willing to teach for the miserable salaries paid. This is a big bill and may require a certain amount of subsidy by industry and interested professional groups.

An interesting and enlightening clarification of this might be made by citing a recent and excellent book, by J. L. Karash (A.S.T.E. Cleveland Chapter Chairman) on the subject of "Analysis of Drill Jig Design." It must be kept in mind that this book—a very creditable and analytical volume—treats only a portion of one of the ten basic technical subjects of tool engineering, and yet, rates the space allotted to it. It is significant, also, that this book is a qualitative analysis and not a quantitive analysis. There is a distinct difference between the two approaches to the subject, as is well recognized in the study of chemistry, to cite an example. There is not only need for additional, similar books on other Tool Engineering subjects, but also for companion books covering the quantitative aspects as well as the qualitative aspects.

It is unfortunate that so many educators consider that an engineer is not an engineer unless he is virtually an animated slide-rule. In other words, opinion is held that extensive and sometimes involved calculations are necessary in order to make any technical subjects engineering in character. What should be done, however, is to have Tool Engineering courses set up on more of such bases, taking out a lot of the hitherto existing guesswork. From this, should come more dependable and predictable performance of tooling equipment.

A Clearer Concept Necessary

What is apparently lacking is a grasp—or concept—on the part of leading educators, of what Tool Engineering consists of—that is, what it consists of at present, what it will consist of in the future, and what Industry's needs are in this respect. There is not only a lack of understanding among the educators, but, naturally enough, among prospective students as well. To educate the educators, and in turn to pass along to embryo engineers an understanding of what Tool Engineering is all about, is currently the task of the Education Committee of the A.S.T.E. With tolerance and open-mindedness on the part of educators, and the cooperation and assistance of industry, its dedicated efforts can be readily brought to a successful realization for the benefit of all concerned.

The current national controversy, with respect to wages, and prices, can best reach final lasting and peaceful conclusion and improvement through better tool engineering. In the final analysis, the reduction of manufacturing costs through better methods of tooling is the only sound and proven way in which our economy can effectively and permanently raise wages and increase purchasing power. The future security of free enterprise, and many of the fundamental things that make America great, are vitally tied to tool engineering. We cannot, in any way, slight our efforts in furnishing this essential profession with the very best in the way of ability and talent for its future task and challenge.

Machine Tool Outlook Bright

Mounting labor costs, combined with a general urge to quickly expand manufacture of consumer goods, are major factors in the current buying of new engine lathes and other machine tools, according to a survey conducted by district managers and sales engineers of the **MONARCH MACHINE TOOL COMPANY**, Sidney, Ohio. Expanded production of redesigned products, as distinguished from new, is a further reason for the orders being received almost daily for new lathes which, so far as can be ascertained, will supplement rather than displace machine tools already on the job.

NOTICE TO A.S.T.E. MEMBERS

Mailing of 1946 Membership Cards has been unavoidably delayed because of delayed deliveries from the printer. However, it is believed that cards to all members, whose current dues have been paid, will be in the mails during March.

By Wilson Scott

Resistance Welding of Mild Steel

Electronic timing, switching and heat control permit exact control of quality and welding time

Resistance welding has been an old art but is now rapidly developing as an exact science. The first resistance welding machines depended to a large extent upon the skill of the operator to produce a weld. Many good welds were made but it was the bad welds that created a difficulty and left a doubt in the engineers' minds as to the quality of the product. Since the method offered good possibilities for high speed production with resultant low costs many investigators have been attracted to the problem and a great deal of effort put forth to develop a fast dependable method of resistance welding. The most important development was the application of electronic timing, switching, and heat control. This equipment permits the exact control of welding time and stepless changes in the current required for producing quality welds.

Wilson Scott **gained practical experience at the Westinghouse East Pittsburgh Works where, in the Materials and Process Engineering Dep't, he developed the manufacture of high temperature, high strength alloys. In the meanwhile, he attended Carnegie Tech, graduating in '33 with degree B.S. in Metallurgy. In 1941, he was transferred to the Sharon Works of the company, where he is now Section Engineer in charge of Welding and Brazing Development. A member of the American Welding Society, he is chairman of the Resistance Welding Committee, and also chairman of the sub-committe on Methods of Testing.**

The first welders depended upon the operator's judgment as to time required for welding and he controlled the time by means of mechanical devices that, in most cases, took more time, because of friction and inertia of moving parts, than is consumed in the actual welding operation with present day equipment. Depending upon the material being welded, the time of current flow will vary from a portion of a cycle to 30 cycles in ordinary operations. In order to expand the capacity of making quality welds, modified technique has made use of various combinations of "heat time" with "current off" periods between to permit the storage of heat in the weld area until the welding heat is reached. The same methods of electronic control have been expanding and it has been found possible to combine heat-treating and welding all in one machine so that the scope of welding is expanding by leaps and bounds to cover more and more materials.

Along with the development of electronic control, it was found possible to introduce a control on the firing tube so as to pass current on part of the wave. We thus have stepless current control instead of the transformer tap adjustment. This enables the operator to control welding conditions within very close limits necessary for quality.

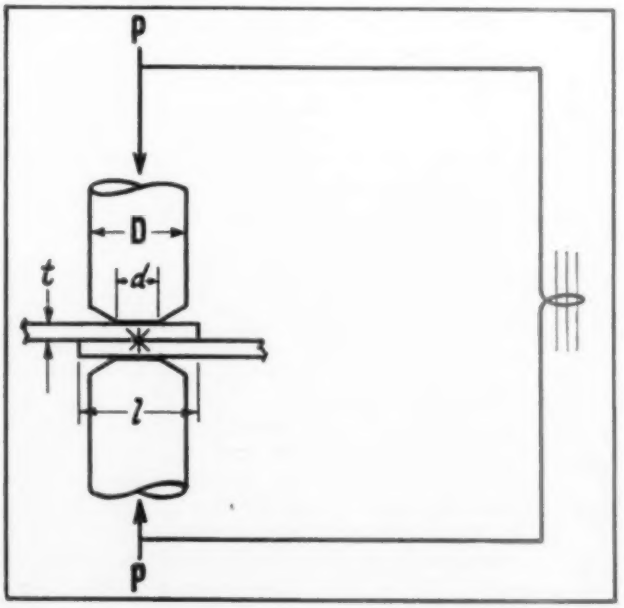
The development of the mechanical features of resistance welders was carried on simultaneously with the development of the controls so that maximum advantages could be obtained from the controls.

Changing trends in industry have placed more emphasis on appearance and quality, and since resistance welding is an ideal tool leaving the minimum trace, it has received a great deal of prominence in new designs. The electronic control and the improved weld furnished the tool and it is now up to the engineer to design properly, and the shop supervisor to see that the designs are consistently carried out. In high quality dependable production use is made of statistical control methods to keep check upon the many variables. Once a chart is established and a standard deviation determined, it is a simple matter to progressively plot day to day conditions, and when an excessive deviation is obtained steps must be taken, immediately, to correct welding conditions.

Designs for Spot and Projection Welding

Of prime importance is the material to be used, and the surface condition. Early welds were made on steel without regard for the surface conditions and some operators still claim consistent high quality welds with scaled or dirty material through the use of a special technique. Most operators, however, prefer to have the material clean before welding. The main difficulty arises from the fact that, when dealing with scaled or dirty material, the scale varies with a corresponding variation in the resistance of the contacting surfaces. When the resistances vary the heat developed will vary. In any case, weld quality and appearance are not controllable. When poor contact exists between the material and the electrodes, the electrodes deteriorate rapidly and require excessive maintenance. This problem has not been definitely cleared, but considerable work is underway to determine the maximum surface resistance that can be

FIG. 1. The single lap joint is the basis of all spot, seam and projection welding designs.



tolerated without impairing quality and without affecting tip life materially.

The simple lap joint (see Fig. 1) is the basis of all spot, seam, and projection welding designs. The amount of overlap required is a direct function of the thickness of material. It is essential that the overlap, if small, be consistent as the material may not be sufficient between the electrode and the edge to support the electrode or the weld nugget under welding conditions. If the overlap becomes large, it wastes material and increases the weight of the product unnecessarily.

In spot and seam welding the electrode size to be used is a function of the sheet thickness being welded. It is necessary to control the contacting area of the tip with the work within very narrow limits (± 5%) as it is by this means that the current density of the welding current is controlled. The heat generated at the weld area is the direct result of current density so that if the current density varies the weld may or may not be consummated. In tip design it is well to keep the tip as large as possible up to the work so as to minimize losses in power.

In some cases it is necessary to use tips having a small "D" (see Fig. 1) so as to get the electrode contacting surface close to a vertical projection on the assembly. In general it is desirable to use the largest tip possible to carry the current only tapering the end to the contact area "D."

When dealing with steel (a magnetic material) changes in the amount of steel in the throat of the machine changes the impedance. This results in less secondary current. This condition, when consistent, can be taken care of by increasing the primary current, but when the material in the throat varies it is impossible, in production, to have the operator

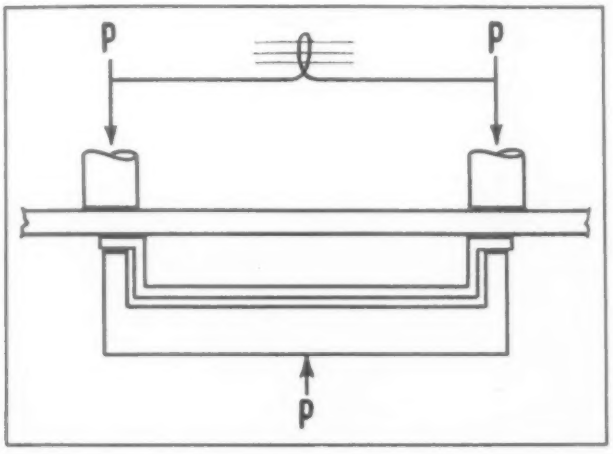
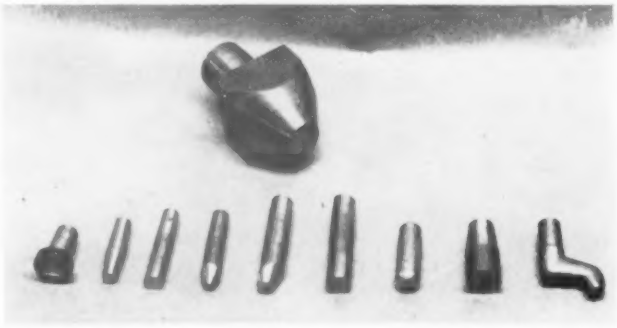


FIG. 2. A simple modification of the conventional welding circuit. Here, the secondary of the welding transformer is connected to two electrodes on the same side of the work material with the electrodes backed up with a short circuiting bar.

Below: A multiple projection die for projection welding four studs at one time on a bushing boss.

Above: Extension tip holders enable the welder to reach into confined spaces such as small cans. The holder on the right is adjustable longitudinally to obtain maximum depth with small clearances. These holders are limited to the welding of thin sections as they will not withstand the pressures required for welding heavy sections.

Below: A range of tip sizes are available—some with modifications for special jobs. The tip on the extreme left is for a projection welded nut which locates in the recess. The next tip is cut down on a long taper to allow for flange clearance and to obtain the proper weld diameter. Tips four and five are machined with the contact area on one side to weld close to vertical projections. The tip on the extreme right is a special forged shape to reech into extremely close quarters.



Complete distribution transformer tanks using a number of projection welded parts. The hangers projecting towards the front of the picture are a good example of the advantages of projection welding over spot welding. Six projections make six welds in one operation while spot welding would require six separate welds.

change the current for each weld. Where only taps are available, if a change in current is required, it may not be possible to obtain a fine enough adjustment, but the variation can be compensated for by changing time, pressure, or electrode contact surface. Where full electronic control is used, it is a simple matter to change the current by small amounts. Fortunately the secondary current can vary over a fairly wide range without materially affecting weld strength and if the surface condition is not an important factor the change in secondary impedance is not of primary importance. Several controls are on the market for automatically correcting the primary current so that a constant secondary current is supplied to the weld.

Common difficulties met with in the shop are caused by spots too close to flanges or because the parts will not fit over the electrodes. The simplest condition is the overlap joint on flat sheets or the assembly of parts on flat sheets. In simple shapes just straight electrodes are required and the only limitation is the capacity of the machine to weld a total thickness and the throat depth of the machine. This imposes too much limitation upon the process and necessitated the development of special holders and shapes of electrodes to make welds in close quarters.

Applications of Resistance Welding

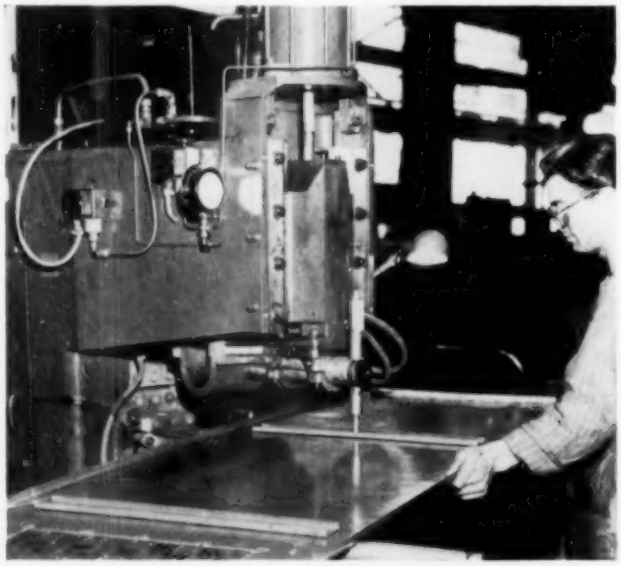
Most applications of spot welding make use of a series circuit making a single weld at one time, but conditions may warrant modifications. When modifications are necessary to effect a weld it is usually only possible when the activity is very high in order to justify the development costs of special equipment. A simple illustration is the spot welding of light reinforcing rings into a tube (Fig. 2). The secondary of the welding transformer is connected to two electrodes on the same side of the work material with the electrodes backed up with a short circuiting bar. When welding current is supplied the short circuiting bar completes the circuit and makes two welds at one time. There are a number of other such modifications, and the most economical should be selected on the basis of the job to do.

Projection welding is an extension of spot welding, and becomes a decided advantage on high activity production since more than one weld can be made at one time. In addition to this advantage large electrodes can be used reducing electrode maintenance. Projections are embossed on one part, the parts assembled and the weld made similarly to a spot weld except that the electrode will not control the spot size; therefore, the electrode can be made larger.

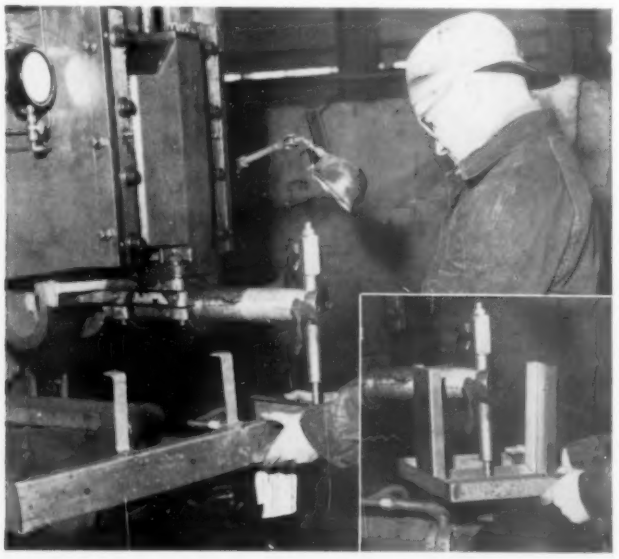
This method uses the embossment on the part itself as an electrode to control current density at the weld, and, therefore, introduces the problem of tooling to control the projection size within very closely maintained limits.

Seam welding is another extension of the spot welding principle, where the electrodes are rotating discs. The use of rotating discs permits strip to be fed to the electrodes continuously and the welds made, spaced as required. As the spots are spaced closer and closer together, the individual welds will finally overlap and the resultant weld is a pressure tight seam weld.

Welding reinforcing ribs to a large panel. The large flat tip on the bottom insures a minimum of marking on the exposed surfaces.



A spot welding set-up with an extension type holder to permit welding in confined spaces.



New Designs—New Materials

50% of NEW DESIGNS STEM FROM IMPROVED BASIC MATERIALS, according to R. C. Bergvall, engineering executive of the Westinghouse Electric Corp'n, who recently discussed the key role of new materials being played in the design of postwar equipment and machinery.

Mr. Bergvall outlined the rise of synthetic materials superior to the natural product, as well as problems facing research men in the development of new and tougher alloys to meet demands created by high temperature machines running at great speeds.

The $64 Question

QUESTION: If two objects of the same size and shape, but differing in weight, are dropped simultaneously from the same height, will they reach the ground at the same time?

ANSWER: If two objects, identical except that one is heavier than the other are dropped from the same height at the same time, the heavier object will reach the ground sooner since air resistance is less in proportion to mass and hence the terminal velocity is higher. In a vacuum all objects fall at the same rate, regardless of size, shape or weight.

CATON

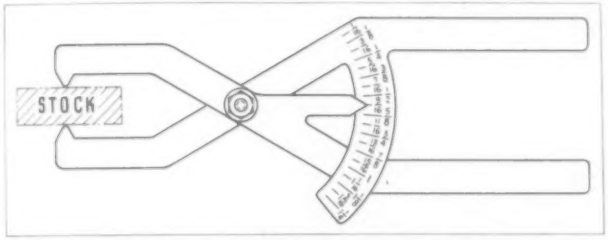
GADGETS

Ingenious Devices and Ideas to Help the Tool Engineer in His Daily Work

Direct Measuring Caliper

THE CALIPER shown is very useful around the shop, and saves time in stock rooms. Also, it is simple and inexpensive. I is made from ⅛ sheet stock. After the parts are laid out and machined, and temporarily assembled, the graduations are laid out by using standard gage blocks between the measuring parts. It is not necessary that dimension A and B be equal, although this might be preferred. However, the measuring points should be hardened.

Frank J. Peragine,
Greater New York Chapter,
A.S.T.E.



Economy of Spot Welding

SPOT WELDING has eliminated dies, jigs and fixtures and has saved time and money in manufacturing a large quantity of utility tables. A standard C-type Progressive portable resistance welding gun and a simple rotary work-holding fixture, built by *Progressive Welder Co.*, 3050 E. Outer Drive, Detroit 12, Mich., made it possible for one man to weld 16 tables per hour.

Contributed.

Takes Own Temperature

A NOVEL USE of color to ascertain temperatures, and which may have wide application in industry, has recently been worked out by engineers of the *General Electric Company*. In this case, a chrome-cobalt composition alloy is being used to determine the operating temperatures of gas turbines. Previously, these powerful combustion engines, in which the turbine wheel whirls at a surface speed in excess of 1,000 miles per hour and creates an intense heat, had defied all attempts to take accurate temperature readings.

The alloy has the peculiar property that it changes color, markedly, for every 25 degrees from 700 to 900 degrees centigrade—or 1650°F. This is believed to be the highest temperature ever to be accurately recorded *inside* a gas turbine. By making turbine parts of the alloy, the turbine has no alternative but to take its own temperature.

Like most metals, the chrome-cobalt alloy changes color due to oxidation under heat. Unlike other metals, however, these color changes occur slowly but definitely at 25 degree intervals, thereby providing an actual graduated color scale according to temperature. The strangest characteristic, however, and which enhances its use, is that after it completes one order—or scale of colors—it reverts back and repeats these colors in a second order in a higher range of temperatures.

For example, it will show light straw at 500° C, straw at 525°, bronze at 550°, purple at 575°, dark blue at 600°, and so on. At 700° C it turns light blue, and according to all precedent, should then turn grey. Instead, it reverts back to light straw at 725° and begins the procession of color all over again. In the second scale, it turns light blue at 900° and shows greying tendencies at 925° C.

Of interest, too, interference colors change as the oxide film changes, until the latter becomes so thick that no color is transmitted through. At this point—indicated by a dull grey—oxidation has run its gamut of colors, and the metal is no longer useful as a gage for measuring temperatures.

Fact and Fancy

RECENTLY, a printed circular, pertaining to ball bearings, came to hand and contained two statements which, in the writer's opinion, are untrue. (1) "The balls in bearings are accurate . . . within .000001" or one millionth of an inch." (2) "A true sphere is the strongest shape for a given size that is known to man."

A random check on a lot of allegedly precision balls showed a variation of as much as plus or minus .0001"—a long way from a millionth of an inch. As for statement 2, that is patently wrong. A cube made of the same material as that of a given ball, and of the same diameter, will certainly be the stronger owing to the flat contact area as contrasted to the "point contact" of the ball.

This is not to be construed as belittling ball bearings which, creating less friction and consuming less power than any other type of bearing, are good enough so that misleading statements need not be made.

W. F. Schaphorst,
Newark, N. J.

THE *Fundamentals* OF TOOL ENGINEERING

The Elements of Gearing

No. 6 of a Series

CALCULATIONS OF GEARS—Continued from February issue

$$\tan B = \frac{FT}{OT} \quad (36)$$

but OT = FS = a pitch Radius of the Pinion, or

$$FS = \frac{N}{2 \times \text{pitch}} = \frac{20}{2 \times 4}$$

and FT is a Pitch Radius of the Gear, or

$$FT = \frac{35}{2 \times 4}, \therefore \tan B = \frac{35 \times 2 \times 4}{20 \times 2 \times 4} = \frac{35}{20} = 1.750''$$

$$\angle B = 60° 15'$$

Angular Addendum DE,

$$\frac{DE}{DH} = \cos B \quad (37)$$

$$DE = DH \cos 60° 15' = .250 \times .49622 = .12406''$$

Outside Dia. $= 8.750'' + 2 \times .12406 = 8.998$ (38)

Pitch Cone Radius OF

$$\frac{FT}{OF} = \sin B \qquad OF = \frac{FT}{\sin B} \quad (39)$$

$$OF = \frac{4.375}{.8682} = 5.038''$$

Dedendum Angle FOU,

$$\tan FOU = \frac{FU}{OF} = \frac{\text{Dedendum}}{\text{Pitch Cone Radius}} = \frac{.2893}{5.038} = .05742 \quad (40)$$

$$\angle FOU = 3° 17'$$

Cutting Angle TOU = $\angle C$

$$\angle C = \angle B - \angle FOU = 60° 15' - 3° 17' = 56° 58' \quad (41)$$

Blank Angle TOW = $\angle A$

$$\angle A = \angle B + \angle FOW \quad (42)$$

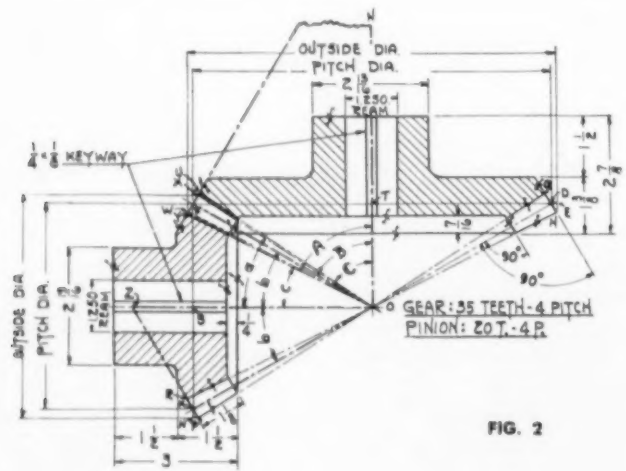


FIG. 2

$$\tan FOW = \frac{\text{Addendum}}{\text{Pitch Cone Radius}} = \frac{.250}{5.038} = .04962 \quad (43)$$

$$\angle FOW = 2° 50'$$

$$\angle A = 60° 15' + 2° 50' = 63° 5'$$

CALCULATIONS FOR THE PINION—20 TEETH, 4 PITCH

$$\text{Pitch Dia. } FK = \frac{20}{4} = 5.000'' \quad (44)$$

$$\text{Addendum } KP = \frac{1}{4} = .250'' \quad (45)$$

$$\text{Dedendum } KR = \frac{1.157}{4} = .289'' \quad (46)$$

$$\text{Whole Depth } PR = \frac{2.157}{4} = .539'' \quad (47)$$

Pitch Cone Angle FOS = $\angle b$ (48)

$$\tan b = \frac{FS}{OS} = \frac{20}{35} = .57143$$

$$\angle b = 29° 45'$$

Check: $\angle B + \angle b = 60° 15' + 29° 45' = 90°$ (49)

Pitch Cone Radius OF = 5.038 (50)

Addendum Angle FOX,

$$\tan FOX = \frac{FX}{OF} = \frac{\text{Addendum}}{\text{Pitch Cone Angle}} = \frac{.250}{5.038} = .04962 \quad (51)$$

$$\angle FOX = 2° 50'$$

Blank Angle SOX = $\angle a$

$$\angle a = \angle b + \angle FOX = 29° 45' + 2° 50' = 32° 35' \quad (52)$$

Cutting Angle FOS = $\angle c$

$$\angle c = \angle b - \angle FOY = 29° 45' - 3° 17' = 26° 28' \quad (53)$$

Angular Addendum KN

$$\frac{KN}{KP} = \cos b \quad (54)$$

$$KN = KP \cos b = .250 \times .86820 = .21705''$$

Outside Dia. $= 5.000 + 2 \times .21705 = 5.434''$ (55)

SELECTION OF MILLING CUTTER FOR BEVEL PINION

The distance **KZ**, Fig. 2, is the radius of an imaginary spur gear of the same pitch. From the triangle ZKO,

$$\frac{KZ}{KO} = \tan b$$

$$KZ = KO \times \tan b = 5.038 \times \tan 29° 45' = 2.879$$

Diameter $= 2KZ = 5.758''$ (56)

Number of teeth in imaginary spur gear is $5.758 \times 4 = 23.032$ or 23 teeth for all practical purposes.

From the table—the proper cutter to use is Nr. 5.

Worm and Worm Gear

A simple worm gear combination consists of a screw meshing with a helical gear. The screw is called the *worm* and the gear the *worm gear*, or worm wheel.

Axis: The axis (shaft) of a worm is usually at right angles to the gear axis (shaft), but other angular combinations are occasionally used.

Lead: The lead—l—is the distance the thread advances in one revolution. Numerically, the lead equals the circumference of a pitch circle times tan a. See Fig. 1.

Linear Pitch: The linear pitch—P—is the distance between similarly located points on adjacent threads of the worm in axial section. This distance is equal to the circular pitch of the gear. See Fig. 1.

Note: If there are several threads in parallel, then the lead is equal to the pitch times the number of threads. The pitch of a double-threaded worm is ½ inch, and the lead—$2 \times \frac{1}{2} = 1$ inch.

Helix angle: The helix angle of a worm is a ratio of a lead and pitch circumference. Angle—a—in Fig. 1, is the helix angle.

Face Angle: The face angle is the angle—b—in Fig. 2.

Angle of side of tooth—is 14½ degrees.

Example 4. Calculate the necessary dimensions for a worm and worm gear so as to utilize a hob already in stock. The hob is double-threaded, 2.800 inches in diameter, and the worm gear must have 50 teeth. The center distance is not important.

Outside dia. of hob = outside dia. of worm + $+ 0.1 \times$ linear pitch $= O + 0.1 \times 0.500$

$$O = 2.800 - 0.05 = 2.750'' \quad (57)$$

$$\text{Addendum } A = 0.3183 \times P = 0.3183 \times 0.500 = 0.159 \quad (58)$$

$$\text{Pitch diameter of worm } d = 2.750 - 2 \times 0.1591 = 2.431'' \quad (59)$$

$$\text{Whole depth of worm tooth } W = P \times 0.6866 = 0.343 \text{ inch} \quad (60)$$

$$\text{Root diameter of worm } R = O - 2 \times 0.343 = 2.063 \text{ inches} \quad (61)$$

$$\text{Width of tool at end} = 0.310 \times P = 0.310 \times 0.500 = 0.155 \quad (62)$$

Helix angle a,

$$\text{From Fig. 1, } \tan a = \frac{l}{\text{pitch circle circumf.}} = \frac{1}{3.1416 \times d} = \frac{1}{3.1416 \times 2.431} = 0.13092 \quad (63)$$

Helix angle $a = 7° 27'$

$$\text{Threaded Length of worm} = \sqrt{8 \times d \times A} = \sqrt{8 \times 7.957 \times 0.1591} = 3.180 = \text{approx. } 3\tfrac{1}{4} \text{ inches} \quad (64)$$

$$\text{Pitch diameter of worm gear } D = \frac{\text{number of teeth} \times P}{3.1416} = \frac{50 \times 0.500}{3.1416} = 7.957 \quad (65)$$

$$\text{Center distance } C = \frac{7.957 + 2.431}{2} = 5.194 \text{ inches} \quad (66)$$

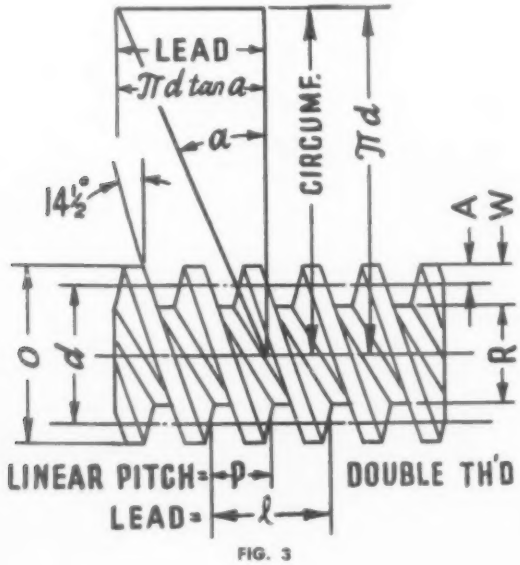


FIG. 3

Throat diameter of worm gear $D_1 = D + 2A = 7.957 + 2 \times 0.159 = 8.275$ (67)

Radius of curvature of worm wheel throat

r = outside radius of worm minus $2 \times A$ = $1.375 - 0.318 = 1.057$ (68)

A good average face angle b is 75 degrees, but the range of face angles is from 60 to 90 degrees. Here, $b = 75$ degrees.

Outside diameter of worm gear to sharp corners,

$$Ds = 2\left(r - r\cos\frac{b}{2}\right) + D_1 = 2(1.057 - 1.057 \cos 37°30') + 8.275 = 8.493 \text{ inches.} \quad (69)$$

Example 5

The design limits center distance between worm and worm gear shafts to 5 inches, speed ratio 10 to 1, 4-threaded worm and 40 teeth in a worm gear. A 20 degree helix angle is desirable.

$$C = \frac{P}{2 \times 3.1416}\left(\frac{\text{number of threads in worm}}{\tan a} + \text{number of teeth in gear}\right) \quad (70)$$

Number of threads in worm $= n = 4$

$$5 = \frac{P}{6.2832}\left(\frac{4}{0.36397} + 40\right)$$

$$P = \frac{31.416}{50.990} = 0.616 \text{ inch}$$

$$\text{Pitch dia. of gear D} = \frac{40 \times 0.616}{3.1416} = 7.843 \text{ inches} \quad (71)$$

$$\text{Pitch dia. of worm } d = \frac{\text{lead cot } 20°}{3.1416} = \frac{nP \cot 20°}{3.1416} = \frac{4 \times 0.616 + 2.74748}{3.1416} = 2.150 \text{ inches} \quad (72)$$

$$\text{Check: } C = \frac{7.843 + 2.150}{2} = 4.997 \text{ inches}$$

The difference between the assumed and calculated center distances is 0.003 inch.

The lead $l = 3.1416\, d \tan 20° = 3.1416 \times 2.150 \times 0.36397 = 2.464$ inches (73)

Check: $P = 2.464 : 4 = 0.616$

The pitch checks with previously determined value.

If the worm or worm wheel do not answer the design conditions, another trial solution might be required. For example, the root diameter of the worm must be large enough to transmit the required power, and the pitch of the teeth is an important factor in this connection. The sizes of the worm and worm gear may cause difficulty. Too large gear or too small worm will require one, or even several trial solutions.

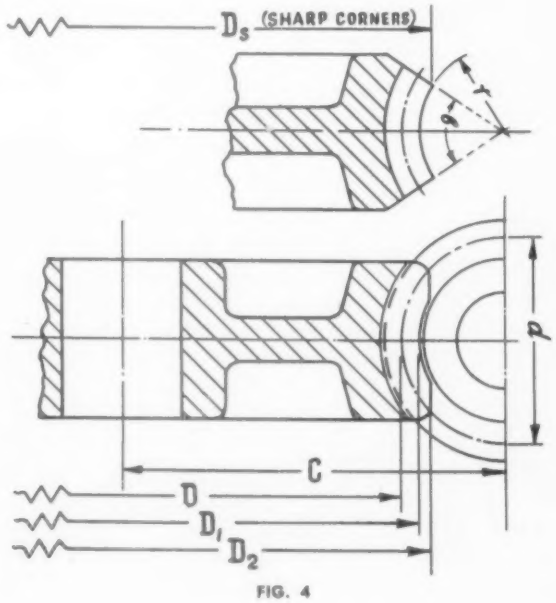


FIG. 4

GOOD READING

A Guide to Significant Books and Articles of Interest in the Trade Press

SIMPLIFIED PUNCH AND DIEMAKING, by James Walker and Carl C. Taylor, is a profusely illustrated 235-page book dealing with the step-by-step development of design, construction and operation of punches and dies. The authors are experienced tool and die makers. James Walker is Die and Mould designer for The Frazer Engineering Co., Dallas, Texas, and is currently serving as Ch'man of the A.S.T.E. Standards Committee, North Texas Chapter. Carl C. Taylor, also an A.S.T.E. member, is supervisor of tool construction with the Southern Aircraft Corporation, Garland, Texas.

Beginning with an introductory chapter that outlines fundamentals of die making for the novice, and also serves as a refresher for experienced designers and draftsmen, the book progresses from the simpler round blanking dies to what-to-do and how-to-do-it in dealing with dies of increasing complexity until all well known types have been discussed.

Published by McMillan Company, 60 Fifth Ave., New York, and blue covered in a handy size for easy reference, the book retails at $5.00 per copy.

PRODUCTION ILLUSTRATION by John Tready, published by John Wiley & Sons, Inc., New York, is an excellent book not only for the commercial artists but for the designers, especially body designers, as well. In part one, the author discusses the drafting standards and practices, shading techniques, reproduction aids, linear perspective and free-hand drawing. In part two, general uses of illustrations, perspective engineering drawings, and manufacturing illustrations are discussed. Price—four dollars.

THE FUTURE OF POWDER METALLURGY, by Paul Schwarzkopf, in January *Powder Metallurgy Bulletin*, published by the author, is a brief summary of what might be expected from a relatively new industry.

DIE CASTING AND PERMANENT MOLD CASTING, two lectures delivered by Alfred Sugar at the Stevens Institute of Technology, and published by *The American Metal Co., Ltd.*, 61 Broadway, New York 6, is an engineering treatise discussing the various alloys, dies, machines, and die-casting and permanent mold techniques.

BRIGHT HARDENING OF TOOLS AND MACHINE PARTS IN CONTROLLED ATMOSPHERES, by C. E. Peck, in February *Machinery*, discusses types of atmospheres suitable for bright-hardening and the equipment for producing these atmospheres. This is the first of two articles.

NEW AND IMPROVED METHODS FOR AUTOMOBILE CYLINDER PROCESSING, by Frank M. Scotten, in December *Production Engineering and Management*, is an article concerning improved machining and metal-treating processes.

HIGH ACCURACY SCREW MACHINE CAMS MADE FROM MEEHANITE, by Ellwood S. Hasbroon in the annual directory number of *Canadian Machinery*, points out that a heat-treated and hardened Meehanite cam lasted 200 hours while a cam made of another material, not hardened, stood up only 30 hours.

CUSHIONED TIPS EXTEND LIFE OF NEGATIVE RAKE TURNING TOOLS, by W. C. Holloway, in January 31st, *American Machinist*, deals with the advantages of using a copper cushion between layers of silver-solder ribbon.

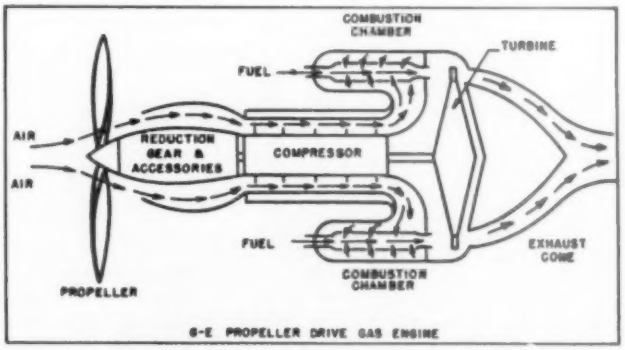
In the same issue, E. K. Morgan, Gen. Sales Manager, Giddings & Lewis Machine Tool Co., repeats his suggestion that the *Machine Tool Builders' Association* should organize a Permanent Machine Tool Exhibit.

UNDERGRADUATE WELDING AWARD, by A. F. Davis of the Lincoln Electric Co., will consist of four cash prizes, totaling $700, to be presented annually to authors and publications for the best and second best articles on welding published in undergraduate magazines or papers during the preceding year. Any undergraduate of a college, university, or institute of technology in the U. S. or Canada is eligible. Judges, selected by the Educational Committee of the American Welding Society, will select the winning paper in July of each year on the basis of originality of the paper and thoroughness in which the subject is covered. The awards will be as follows: $200 each to the author of the best paper and to the publication in which it appears, and $150 each to author and publication for second best paper.

NEW TYPE AIRPLANE POWER PLANT

The Jet Propulsion Power Plant—the G.E. Propjet—developed by General Electric Co., has been described in a recently released 5-page booklet.

The new aircraft power unit, which is a gas turbine with propeller, was designed for installation in the wings of multi-engined aircraft or in the nose of a single-engine plane. The air rams into the nose of the Propjet through ducts opening forward. This air is compressed by axial flow units in the forward part of the engine and then forced into combustion chambers. There, fuel is injected, to burn intensely, raising the temperature and velocity of gases which then strike the buckets of the turbine wheel with great energy. The turbine powers the compressor and, through reduction gears, drives the propeller.



G-E PROPELLER DRIVE GAS ENGINE

This new aircraft power unit established the following major design advances: Lighter weight engines carrying increased loads; simplicity and compactness; virtual elimination of vibration, even when operating at maximum power. The Propjet functions most efficiently and economically at full power at high altitudes during long flights.

BULLETINS AND TRADE LITERATURE

Items briefed herein have been carefully selected for their interest and application. Unless otherwise stated, all are available, free, from the stated sources.

WALES-STRIPPIT CORP., 345 Payne Ave., No. Tonawanda, N. Y., recently published a new catalogue describing and profusely illustrating blanking, drawing and forming dies, and punching machinery.

A new catalogue, describing and illustrating the *Gusher* machine tool coolant pumps, will be mailed on request by **THE RUTHMAN MACHINERY CO.**, 1809-23 Reading Road, Cincinnati 2, Ohio.

A 32-page illustrated catalogue, describing the new standard *Rotocast* hydraulic cylinders and containing valuable engineering data, is offered by the **LOGANSPORT MACHINE CO., INC.**, Logansport, Ind.

A new illustrated catalogue, showing views of a plant, as well as a complete listing of machinery and equipment, will be mailed on request by the **RANE TOOL CO., INC.**, designers and makers of tools and gages, 17 Ross St., Jamestown, N. Y.

DIAMOND-DETROIT, INC., 6-253 General Motors Bldg., Detroit, has issued carefully edited and fully illustrated catalogue—*Diamond Products for Industry*. The diamond tools, accessories, and metal-bonded diamond wheels are fully described.

Involute Splines and *Roto Shavings* are two illustrated folders, just published by **NATIONAL BROACH & MACHINE CO.**, 5600 St. Jean Ave., Detroit 13.

A strip folder, listing a complete line of arc welding electrodes, can be obtained by writing to **THE HOBART BROS. CO.**, Troy, Ohio.

Best's Safety Directory & Catalog, by **ALFERT M. BEST CO.**, 75 Fulton St., New York, gives a complete, illustrated compilation of all safety, hygienic, first aid and fire protective products and devices.

THE EMELOID CO., 286 Laurel Ave., Arlington, N. J., has just issued a new 24-page catalog, *Plastic Advertising Specialties of Distinction*.

Three pamphlets: "Glossary of Technical Terms Used in Diamond Industry," "Industrial Diamond Development in England in 1945," and "Trade Names Index" will be sent free on request by P. Grodzinski, 41 Tudor Close, Belsize Ave., London N. W. 3, England.

RECTIFICATION OF HIGH SPEED STEEL SALTS, by Stewart M. DePoy, in No. 17 *Production Data*, E. F. Houghton & Co., publishers, presents the results of experiments with the graphite rod method of salt bath rectification. **THE BLACKENING OF STEEL**, by F. L. Atkin, in the same issue, describes the low temperature oxide baths and lists their advantages.

CLASSIFICATION AND SYMBOLS FOR IDENTIFICATION OF HIGH SPEED STEELS, fifth edition, by Gorham Tool Co., 14400 Woodrow Wilson Ave., Detroit 3, is a valuable 24-page booklet. The title plus the quenching and drawing temperatures for various steels—give the contents of the booklet in full.

GENERAL ELECTRIC CO. has issued literature covering *the application of arc welding* to railroad work.

KYLE-JOHNSON MACHINE CO., 1627 West Price Blvd., Los Angeles 15, has published a circular describing *K-J Quick Change Lathe Tools*.

BEAVER TOOL & ENGINEERING CORP'N, 2850 Rochester Rd., Royal Oak, Mich., has available a circular describing the advantages of *Solid Carbide Face Mills*.

ALEXANDER BROS., 406 N. 3rd St., Philadelphia 3, have issued two folders covering assorted leather packings and table of standards.

MID-STATES EQUIPMENT CORP'N, 2429 So. Michigan Ave., Chicago, has published a new folder describing the *Metal Zipper Arc Welder*.

McKIERNAM-TERRY CORP'N, 15 Park Row, New York 7, published *The Mechanical Blacksmith's Helper*, a brochure describing the company's line of power hammers.

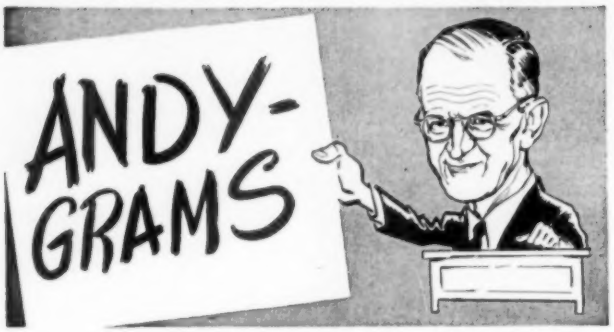
S. B. WHISTLER & SONS, INC., 752 Military Rd., Buffalo 17, has issued catalogs No. 44, 45 and 45A illustrating and listing single-hole and heavy duty adjustable perforating dies.

BRENNER ELECTRIC MFG. CO., 5100 N. Ravenswood Ave., Chicago 40, has issued a folder illustrating the use of the industrial *vacuum cleaner, a blower and an electric writing tool*.

Precision Tapping Blind Holes

PARTS HAVING an 1½"-12 N.F. thread, ¾" deep on one end, and ⅝"-18 N.F., blind, in the opposite end, are being tapped in close concentricity with equipment designed and built by *Detroit Tap & Tool Co.*, Detroit. Tooling speed, with accuracy, results from use of two-position shuttle type fixtures provided with air operated clamps and positioners.

The machines used are "Detroit" light (LTM and MTM) duty tapping machines, with two-piece work holders bearing on convergent vertical ways for clamping and horizontal locating and vertical positioning pins for accurate control of tapping depth. The taps for the blind holes are standard 4-flute "Detroit" taps ground with a short chamfer, driven at approximately 70 ft./min. and guided by lead screws relieved of cutting torque.



Y'KNOW, I had the column all written and ready for the printer when, bang out of a blue sky, Ot Winter sent in an article that said about the same thing, only in different words. The sonofagun! But, who am I to contend with the militant standard bearer of the A.S.T.E. Educational Committee? Now, I've got to grope around for a new theme, and just when I'm "all pooped out," as the old lady said in *Suds in Your Eye*. Fact is, I tried to fight the flu with passive resistance, as a result of which a li'l complication plopped me back into bed.

At that, I played in luck, apropos which I have the pleasure of introducing a new member of the staff—Alexander P. Gwiazdowski, who has recently joined us as Associate Editor. A former professor of engineering at U. of M., Toledo U. and Case School of Applied Science, Alec is a dyed-in-the-wool tool engineer and a strong contender for tool engineering courses. He was one of the first to teach the subject and has written several books on tool engineering that make mighty "good reading."

With Alec pinch hitting, I took my vacation (?) with an easy mind. Doc fixed me up with a gunful of penicillin and some new-fangled sulfa drug—pink, this time—although he bucked the traces some a/c I had my "office" scattered all over the bed. Anyway, I'm back on the job, the spirit willing as ever even if the flesh is a bit reluctant. And we're organized, the book came out on time and, as far as I've been able to ascertain from close scrutiny, with only three typographical errors. *Voila!*

I'm finding out, though, that it's no use putting THE TOOL ENGINEER to bed and calling it a day. Sure as pop, if we kill type after publishing, we're bound to get a raft of requests for reprints, sometimes months after publication. To meet this demand, Bob Powers has suggested that we reprint related articles in pamphlet form, to be sold at a nominal sum—say about 25c each. What do you boys North, East, West, South think of the idea?

Now, coming back to Otto Winter, whose article appears on page 57. Otto takes issue with conventional education and espouses engineering courses based on tool engineering needs. And I'm with him! For until recently, formal education has not been directed toward the practical way of doing things; there's been too much of theory and too little of practical "know-how." As a consequence, the tool engineer had not only to develop the tools and methods for mass production, but the science as well. And that, in turn, is bringing about a revolution in education—at least, as it applies to the mechanical arts.

Oddly enough, formal education has tended to stifle rather than to encourage mechanical progress. This point is well illustrated in a condensed article—"Civilization, to John Ericsson, Debtor"—in February *Reader's Digest*. While famed as the inventor of the Monitor—and orthodoxy denied that forerunner of modern naval craft—Ericsson's outstanding contribution was the invention of the screw propellor. Yet, despite that formally educated engineers saw his screw propelled boat running, day in and day out, they nevertheless declared it impractical.

Such resistance to the new is not unusual. Time and again, orthodoxy has decreed that a thing couldn't be done; that it was against natural as well as mechanical laws. And presto!—along has come some uninhibited rebel against convention (you know, don't do it first) who's gone right ahead and done the impossible.

Fortunately, time is bridging extremes. During the late war, formally trained engineers—mechanical, electrical, metallurgical, chemical and others—performed miracles in the field of invention. But, when it came to producing these things, the tool engineers took over and paced their confreres, step by step, to the ultimate goal—mass production on a scale previously undreamed of.

All that, of course, implies collaboration, and out of it is coming a realization of mutual worth and values. The academically trained is coming to realize that theory must be reduced to concrete substance; that atomic energy and jet propulsion, to cite examples, must be tooled for production if they are to become factors in the scheme of human progress.

In turn, the tool engineer has long since come to realize that practical experience is not enough; innate mechanical ingenuity (an essential in tool engineering) must be supplemented with technical training. Hence, his contention for tool engineering courses. And here, the tool engineer has burned his bridges behind him. For, he has already brought the tool to such a state of perfection that, to improve on established quality, science and practical know-how must henceforth go hand in hand. All this portends a radical change in our thinking.

This transition is not unique with America. Recently, I was a guest at a dinner sponsored by Herman Ortegren, chief draftsman at Bower Roller Bearing Company, in honor of a visiting college mate—Will Wallin—from Sweden. In the course of animated conversation, in which notes were closely compared, it was brought out that there is a strong upsurge, in Sweden, of an engineering group closely analogous to the A.S.T.E.

From correspondence, and personal meetings with engineers, industrialists and educators, I find that there is a growing recognition of tool engineering throughout the Scandinavian states. The libraries of several Norwegian industries and technical schools, for instance, have subscribed to THE TOOL ENGINEER, while the Chalmers Institute of Gothenburg—of which, incidentally, many A.S.T.E.'ers are graduates—has requested exchange of papers. All this is with a view toward promoting mutual interest in tool engineering. Along similar lines is a letter from Dr. H. Orenstein, management consultant, Glasgow, which is quoted in gist:

"Dear Mr. Rylander:

". . . As you may . . . know, I had suggested establishing a branch . . . in Great Britain, but as this was during the war . . . the time was unsuitable . . . however, there would be a great interest in THE TOOL ENGINEER . . . and . . . I shall gladly take the opportunity of contacting the leading tool engineers in this country regarding the establishing of a Chapter." So, coming events casting their shadows before them, it seems that we, the tool engineers, are destined to bridge the oceans.

Andy

A.S.T.E. NEWS

NEWS OF INTEREST AND ABOUT MEMBERS

Convention Committees Plan Ambitious Program

FINAL ARRANGEMENTS for the extensive program of activities to be conducted during the combined ASTE New Era Exposition and National Membership Meeting at Cleveland, April 8-12, were completed in a joint meeting of the National Program Committee and the Cleveland Show Committees held February 15 and 16 at Hotel Statler, Cleveland.

National Program Chairman H. D. Hall presided over the two-day session which was attended by First Vice-Chairman W. B. McClellan, Second Vice-Chairman R. W. Ford, Secretary E. W. Baumgardner, Earl V. Johnson, H. E. Linsley, F. J. Schmitt, and Stephen Urban, all of the National Program Committee. National Education Committee Chairman O. W. Winter, who is directing two important sessions on tool engineering education, was unable to be present.

Members of the Cleveland Show Committees present included: J. I. Karash, General Chairman; William Reiff, Jr., Accommodations Chairman; J. R. Fitzsimmons, Banquet Chairman; R. E. Harrold, Meeting Arrangements Chairman; H. E. Peiffer, Plant Tours Chairman; Richard Miller, Reception Chairman; and J. H. Schron, Sign Chairman. Mr. Baumgardner of the Program Committee serves also as Film Chairman.

Complete details of the ASTE New Era Exposition and National Membership Meeting in Cleveland, April 8-12, appear on Pages 18-27, inclusive, of this issue. Other convention news is reported in subsequent pages of the ASTE News section.

In addition to the personnel of the two committees, the meeting was attended by C. V. Briner, President; A. M. Sargent, First Vice-President; H. E. Conrad, Executive Secretary, and Miss Dorothy Meyer, Program Department, National Headquarters; J. V. Friel of Reber-Friel Company, Operating Show Manager; Robert B. Powers, Executive Editor, and Miss Doris B. Pratt, ASTE News Editor, THE TOOL ENGINEER.

Members of Mr. Hall's committee, each of whom is chairmanning a specific technical symposium, named speakers and subjects lined up for their respective sessions. The attractive program developed by this group appears in the main editorial section of this issue.

Mr. Karash called upon his committee chairmen for reports of their efforts in making local physical arrangements. Each report and its accompanying suggested budget was carefully discussed, Messrs. Briner, Sargent, and Conrad serving in an advisory capacity.

Some of the events to be staged under the direction of the Cleveland Chapter group are described in the special show and convention section of this issue.

Administrative duties in connection with the smooth and orderly handling of a national assembly, such as housing, reception, entertainment, mechanical arrangements and information services, are being assumed by the host Chapter committees.

They will staff an office in the Public Auditorium where visitors may register for plant tours, purchase banquet tickets, and secure general or specific information. These quarters will be shared by the National Program Committee.

At the conclusion of the conference, the National Program Committee went into session to formulate operational policies and to draft recommendations for consideration by the Resolutions Committee at its pre-convention meeting.

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Meeting at Hotel Statler, Cleveland, February 15-16, the National Program Committee and the Cleveland Show Committees completed arrangements for the varied program to be presented at the ASTE New Era Exposition and National Membership Meeting in Cleveland, April 8-12. Around the table are, outside left row, front to rear: F. J. Schmitt and H. E. Linsley, Program Com.; J. V. Friel of Reber-Friel Co., Operating Show Mgr.; and Robert B. Powers, Executive Editor, The Tool Engineer. Second row, in same order: Earl V. Johnson, Program Com.; William Reiff, Jr., Accommodations Chmn.; Harry E. Conrad, Executive Sec'y; and Doris B. Pratt, ASTE News Editor. At head of table, left to right, are: J. I. Karash, General Chmn., Show Commitees; H. D. Hall, Nat'l Program Chmn.; and C. V. Briner, Pres. At right of table, front to rear, are: R. E. Harrold, Meeting Arrangements Chmn.; H. E. Peiffer, Plant Tours Chmn.; Dorothy Meyer, Program Dept., Nat'l Hdqtrs.; W. B. McClellan and E. W. Baumgardner, Program Com. Outside row: Stephen Urban, Program Com.; A. M. Sargent, 1st Vice-Pres.; J. H. Schron, Sign Chmn.; and R. W. Ford, Program Com.

Unique Registration Plan to Prevent Show Bottleneck

Novel and simple, the registration system developed for the ASTE New Era Exposition and convention in Cleveland next month will eliminate tiresome queuing and permit visitors to enter the show without delay.

A combination registration card and invitation is being mailed to all ASTE members, to guests of exhibitors, and to others affiliated with industry.

Presentation of this card is required for admittance to the Exposition.

The form bears at the left a perforated badge insert filled in with the name, address, and company affiliation of the recipient. Color bands, across the top and bottom, identify the visitor as an ASTE member, a non-member, or an exhibitor.

Below this another perforated section carries a duplicate of the holder's address, placed to fit the window of a business envelope and serving as a mailing address. Spaces for the visitor's Cleveland address and telephone number are to be filled in before the card is presented at the Registration Desk.

A formal invitation to the Exposition appears at the right. Instructions for using the card are printed on the reverse side, as well as an official badge correction form, in the event the prospective guest has recently changed his company affiliation or address.

In such case, the correct information is filled in and the card returned to ASTE Headquarters for re-issue.

When the Exposition guest enters the Public Auditorium at Cleveland, he hands the *entire card*, with his registration fee of $1.00, to an attendant at the Registration Desk.

The badge insert is quickly torn out and returned to him inserted in a lapel case. With this identification, he has access to the Exposition throughout the five days that the show is in operation.

The Exposition will not be open to the general public nor to curiosity seekers, assuring leisurely and comfortable inspection of exhibits by the Society's guests.

Inch Once Measured With Wheat Grains

Richmond, Ind. — "Economical Control of Production Gauging" was the subject of the technical address presented by John A. Harrington of the DoALL Company at the February 12 meeting of Richmond Chapter.

Mr. Harrington, a graduate of Massachusetts Institute of Technology and President of the Savage Tool Company, gave an informative talk on measurements and gauging.

Briefly, he traced the history of measurement, citing that in 1812 the U. S. Government gave a contract accompanied by an envelope containing three grains of wheat to be considered as one inch in fulfilling the contract.

He stated also that as recently as World War II $2,000,000 worth of tools and dies were rendered worthless because the manufacturers did not have a "standard inch" with which to work. His talk was illustrated with slides, gauge blocks, and gauging mechanisms.

Chapter officers elected at this meeting are: Chairman, Jesse W. Johnson, Perfect Circle Co.; First Vice-Chairman, Louis F. Wahl, R. D. Suman Co.; Second Vice-Chairman, Claude M. Crane, Indiana Tool Co.; Treasurer, Harvey V. Murphy, International Harvester Co.; and Secretary, Lowell B. Penland, National Automatic Tool Co. Chairman Roland Lockridge was elected Delegate to the national convention.

AMERICAN SOCIETY OF TOOL ENGINEERS

SAVE THIS CARD AND BRING IT WITH YOU

It is your OFFICIAL BADGE *and Registration*

DO NOT DETACH CARDS

Registration Fee $1.00

New Era EXPOSITION

CLEVELAND ADDRESS _____ TEL. No. _____

A Cordial Invitation

to attend the

AMERICAN SOCIETY OF TOOL ENGINEERS

New Era Exposition

to be held at

Cleveland Public Auditorium

April Eighth through Twelfth

Nineteen Hundred Forty Six

OVER

This will be the largest industrial exposition of its kind . . . an unusual opportunity for you to see firsthand the new designs and engineering projects on which America's new peacetime industry must be built. Manufacturers and industrial engineers will exhibit their latest developments. This is industry's show for industry . . . *by invitation only*. You are urged to attend.

It is requested that you please:

One — Bring this complete invitation bearing your name and business address to the Exposition. Write in your Cleveland address and telephone number.

Two — Your cooperation in having your invitation properly filled in will make it possible for you to gain immediate entrance to the exhibit upon arrival at the Auditorium. There will be no delay for registration upon presentation of this invitation. Part of this invitation serves as your identification. Admission by this method only.

Official Badge Correction

It is important that your name and initials, title, company and address appear correctly on this invitation.

Should any error appear on your invitation, please make corrections in the space provided below and return this card in its entirety to American Society of Tool Engineers, Exposition Committee, 1666 Penobscot Building, Detroit 26, Michigan. A new card will be mailed to you, promptly.

NAME _____

TITLE _____

COMPANY _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

OVER

This is the unusual, combined registration card and invitation designed to speed up the handling of the thousands of visitors expected at the ASTE New Era Exposition in Cleveland, April 8-12. Name, address, and business affiliation of the invited guest will be filled in before it is sent to him by the Society or its exhibitors. Complete card is required for admittance. Face of card is shown above, reverse side, below.

Membership Committee Issues New Application

A new membership application form, obsoleting previous blanks, has been issued by the National Membership Committee, under the direction of Chairman V. H. Ericson.

V. H. Ericson

The present form incorporates the recently-adopted Affiliate and Associate grades of membership and the current scale of dues. It was drawn up with a view to facilitating National Headquarters operations and to coordinate with the mechanical equipment at the National Office.

The white, four-page folder includes, in addition to the usual spaces for factual information, definitions of the various grades of membership and excerpts from the Constitution and By-Laws, governing promotions, transfers, re-applications and dismissals.

A supply of the new form has been sent to each Chapter.

Index for Data Sheets To Be Available Soon

The new and long-contemplated index for ASTE Data Sheets will be distributed to the Society membership with the next mailing of Data Sheets, the National Standards Committee reports.

W. A. Thomas

Shortly after the appointment of W. H. Smila as National Standards Chairman, he established a subcommittee to review proposed data sheets prior to printing and to create a suitable index for all data sheets published during the past ten years. Their efforts on the latter activity have resulted in a comprehensive listing of approximately 175 products, cross-indexed by company and product.

The Data Sheet Sub-Committee is headed by Grant S. Wilcox, Jr., as Chairman. Other members of the Committee include W. A. Thomas, William Moreland, and L. B. Bellamy.

In addition to serving on this Committee, Messrs. Thomas and Bellamy are Standards Chairmen for Windsor and Detroit Chapters, respectively.

"Investment Casting" Neill's Subject

San Francisco, Calif. — R. J. Neill, District Manager, Haynes Stellite Company, addressed the technical session at the January 15 meeting of Golden Gate Chapter, held in the City Club Hotel, Oakland.

Mr. Neill explained the "Investment Casting Process," supplementing his talk with a display of samples produced by this method.

Preceding the technical session, J. W. Lindgren, District Manager of the International Correspondence Schools, gave an entertaining coffee talk.

More than 100 members and guests attended the dinner meeting.

Explains Extrusion Of Thermo Plastics

Bridgeport, Conn. — January meeting of Fairfield County Chapter was held on the 9th at the Algonquin Club.

The technical session was devoted to a presentation of "Extrusion of Thermo Plastics" by U. S. Avery of the Celanese Corporation, New York City. Mr. Avery explained the uses of acetate paper in peacetime production.

F. C. Victory, Chief Engineer, Moore Special Tool Company, discussed "The Place of Tool Engineers in the Educational System."

During the meeting, Chairman Carl Christensen presented a diamond-set Past Chairman pin to A. S. Curry, on behalf of the Chapter.

Approximately 50 members and guests attended the dinner meeting.

Carl Christensen, Chairman of Fairfield County Chapter, pins on his predecessor, A. S. Curry (left), the Chapter's gift of a diamond-set Past Chairman pin. Presentation was made at the January 9 meeting in the Algonquin Club.

High Speed Operations Make Balance Vital

Toronto, Ont.—Werner Senger, Manager, Balancing Machine Div., Gisholt Machine Co., Madison, Wis., gave an educational address on "Balancing Machines" before an audience of 120 at the February 11 meeting of Toronto Chapter in Malloney's Art Gallery.

Pointing out that balance is becoming more and more essential on machine tools because of the greatly increased speeds of operation, the speaker emphasized that all tool engineers require a complete knowldge of balancing methods.

If design is correct, balance becomes a "must." Quicker balancing techniques and better balancing machines must always be the aim of progressive industries, he declared.

Mr. Senger reviewed methods of balancing machine assemblies and described various balancing machines. He compared earlier methods to modern, up-to-date procedures with machines that register the exact amount of metal to be removed by drilling, and precisely where the drilling should be done to balance an assembly.

A sound film, "Training Operators," showing applications of Gisholt Turret Lathes to speed timing operations, proved interesting and instructive. The film was furnished by J. H. Ryder Machinery Company of Toronto.

Past Chairman Fred Schytte conducted the election of the following Chapter Officers: Chairman, W. W. Appleton; First Vice-Chairman, L. M. Jardine; Second Vice-Chairman, G. W. Elliott; Treasurer, H. C. Upton; and Secretary, J. B. Burk.

Reveals Army's Problems in Tooling Theodolite

Schenectady, N. Y.—An outstanding technical session was presented by Schenectady Chapter January 17 at the W. & L. E. Gurley Co., Troy, N. Y., when Harold R. Larsen, Optical Engineer, lectured on "Problems in Tooling for the Gurley Four-Inch Army Theodolite."

The speaker detailed the history and manufacture of the theodolite in his illustrated talk. Mr. Larsen said that the optical-reading type of theodolite was first patented by Heinrich Wild of Bern, Switzerland, in Germany and the United States in 1908.

Indicates Angles Precisely

The theodolite is a small, compact, and completely enclosed type of instrument for reading horizontal and vertical angles to one second in precise surveying. This is done without change of stance through an auxiliary telescope paralleling the main telescope.

Lenses and prisms are employed to produce two juxtaposed images of diametrically opposite positions of the limb in the plane of an optical micrometer scale.

By this means, Mr. Larsen explained, readings can be made directly to one second with finer interpolation if necessary, and are in effect the mean of reading both sides of the limb separately. Horizontal and vertical angles are read alternately. The short telescope is equal optically to a Gurley Standard Dumpy Level.

This type of theodolite, he said, is valuable because of the speed and accuracy with which angles can be read, a matter of great importance in front-line surveying operations.

In November of 1940, the speaker related, his company accepted a contract to develop a small, conventional model theodolite for the Army, but was later persuaded to try to make the optical reading type.

Successive models were built as limitations on materials were overcome and experience was gained in the construction of this type of instrument.

Finally in December of 1944, he recalled, the first production, four-inch Army theodolite became a reality, the first of the optical reading type to be constructed in the Western Hemisphere. The Army used the theodolite to set their gun batteries more accurately and more quickly. It is a faster instrument than any other tool used for transit work, Mr. Larsen pointed out.

In conclusion, Mr. Larsen said that the theodolite, "a glorified transit," needs only two operators—one to read the instrument, the other to record the readings—whereas conventional transits require three men.

Many of the 65 members and guests present took advantage of the subsequent discussion period to ask the speaker specific questions concerning the theodolite.

ASTE and AIEE Groups Hear "Electronics" Talk

Rockford, Ill.—On February 7, Rockford Area Chapter held a joint dinner meeting with the Rock River Valley Sub-Section of the American Institute of Electrical Engineers at Hotel Faust.

The speaker for this meeting was B. T. Anderson, Chief Electrical Engineer, Sundstrand Machine Tool Co.

His lecture on the "Application of Electronics to Machine Tools" was illustrated with slides showing the versatility of electronics in operating machine tools.

Approximately 250 people attended the meeting of the two organizations.

Banquet Ticket Sale Opens, Early Reservations Urged

To avoid disappointment, advance reservations must be made immediately for the Society's Annual Dinner Thursday evening, April 11, in Hotel Statler, Cleveland.

While ASTE members will have preference in the order in which their reservations are received, heavy banquet attendance is expected from New Era Exposition exhibitors, their staffs, and other show visitors.

Accommodations in the Grand Ballroom where the function takes place are limited to 700. A considerable portion of this seating capacity will undoubtedly be absorbed by delegations from local and nearby Chapters.

To facilitate the handling of reservations, the coupon on this page should be filled in, attached to check or money order (not cash) and mailed to National Headquarters. Tickets will be forwarded promptly, eliminating the confusion and uncertainty of securing last-minute reservations at Cleveland.

Mr. A. M. Schmit, National Secretary
American Society of Tool Engineers
1666 Penobscot Building, Detroit 26, Michigan

Please reserve _____ tickets for the Annual Dinner of the American Society of Tool Engineers to be held Thursday evening, April 11, at Hotel Statler, Cleveland, Ohio. Remittance of $ _____ for _____ tickets at $6.00 each is enclosed herewith. Please send my tickets to the following address:

Signed _____

Address _____

Date _____

Requests for reservations must be accompanied by checks or money orders. *Do not send cash.* Tickets will be mailed immediately.

MAIL THIS COUPON TODAY

Zorn Describes Feeds For Punch Presses

St. Louis—At the February 7 meeting of the St. Louis Chapter, Herman Zorn, President, W&O Press Co., Hudson, N.Y., discussed special feeds as applied to punch presses.

Herman Zorn

Mr. Zorn's address illustrated with slides and motion pictures concerned roll, grip, bar, and dial feeds safety controls.

A capacity audience of 369 members and guests enjoyed the lecture and dinner meeting.

In the absence of Chairman Willis G. Ehrhardt, who has been commissioned to South America, the election of Chapter officers was conducted by First Vice-Chairman J. J. DeMuth.

Candidates elected were: Chairman, J. J. DeMuth, Methods Engineer, Sligo Iron Co.; First Vice-Chairman, E. H. Ruder, Supt., Sunnen Products; Second Vice-Chairman, Harold Creasey, Supt., General Metal Products Co.; Treasurer, O. W. Johanning, Mgr., Machine Tool Dept., Colcord Wright Machinery and Supply Co.; and Secretary, Rudy Kien, Master Tool Designer, Carter Carburetor Corp. Mr. Ehrhardt was elected Delegate to the National Convention in April, with Mr. DeMuth as Alternate.

* * *

Frank McGuire, Engineer for The Linde Air Products Co., Central Div., Chicago, Ill., spoke January 3 before 125 members and guests in the Colonial Room of the Melbourne Hotel.

His subject was the "Oxy-Acetylene Cutting Machine as a Machine Tool." Mr. McGuire has spent considerable time in his company's laboratory and in the field, helping welding and cutting users with development and problems pertaining to the process.

The speaker used slides to illustrate his talk and showed the many intricate shapes possible with the cutting torch. He related how torch cutting supplanted the sawing of ship plates during the war, thereby greatly increasing production.

The speaker answered questions from the floor at the conclusion of his talk.

Film Relates Copper Saga

Fond du Lac, Wis.—Ninety members and guests of Fond du Lac Chapter gathered January 11 at Club 41, Oshkosh, for their regular monthly dinner meeting.

"Golden Horizons," a sound film in technicolor, was presented by Ampco Metal, Inc., of Milwaukee, as the technical feature. The production outlines the history and development of copper-base alloys. From prehistoric days when primitive man accidentally discovered copper ore and fashioned crude tools or weapons, the action leads up to the modern use of copper-base alloys in industry.

The pictures show Egyptian slaves operating a bronze furnace, Sumerian metal workers bargaining for ore, the Swiss lake dwellers, and a 17th century forge shop. Following the historical sequence, the film pictures the modern use of bronze in American industry.

Members of the cast appearing in the production are all Ampco Metal employees. Many of the props were supplied by the Milwaukee Museum.

Travel Restrictions Off — Chartered Service Restored

Current removal of all travel restrictions lifts the last of the wartime bans on civilian use of public transportation in time for prospective visitors to the ASTE New Era Exposition in Cleveland, April 8-12, to plan their trips accordingly.

Advance reservations may be made without time limitations or priorities; Pullman sleepers have been restored to runs as short as 250 miles; and new equipment is being added as fast as it is returned by the government, overhauled and reconverted to public service.

Many carriers expect to have sufficient equipment available next month to offer chartered transportation to convention groups.

ASTE Chapter officers may ascertain the extent of such facilities available between their respective communities and Cleveland by contacting local transportation representatives. All arrangements for chartered service should be made at the point of departure.

Large Chapters or groups of smaller neighboring ones may be able to work out a daily shuttle schedule operating to and from Cleveland during the five-day show and convention.

In addition to the increased rolling stock going into service on the railroads, airlines have re-inaugurated domestic flights on the big, four-engined planes loaned to the Air Transport Command for the duration. Along with 35% higher speed, the de luxe airliners offer lounges, card rooms and improved food service.

Members in the Detroit area may charter D & C lake liners for special cruises to Cleveland. Regular service on the Detroit-Cleveland line is expected to begin April 1.

Bus companies can furnish chartered coaches from some points, the extent of this service being dependent upon delivery of new stock and repair parts.

Cooperation of the various public carriers should provide adequate transportation for all those legitimately interested in attending the ASTE show and convention.

Uses Light to Measure Millionths of an Inch

Flint, Mich.—"Light Waves and Their Use in Precision Shop Measurements," an abstruse scientific subject, was lucidly explained to members of Flint Chapter by Adam Gabriel, Vice-President, Acme Industrial Company, Chicago, Ill., in an address before the group's January 17 meeting at the Herman Fischer Hotel in Frankenmuth.

Tracing the study of light waves from the time of Sir Isaac Newton, Mr. Gabriel described the separation of blended light into individual wave lengths, permitting the use of interference-creating instruments to obtain measurements of great accuracy.

In addition to optical flats for measuring millionths of an inch, he outlined the uses of measuring devices such as the steel ruler, the micrometer, the comparator and gage blocks.

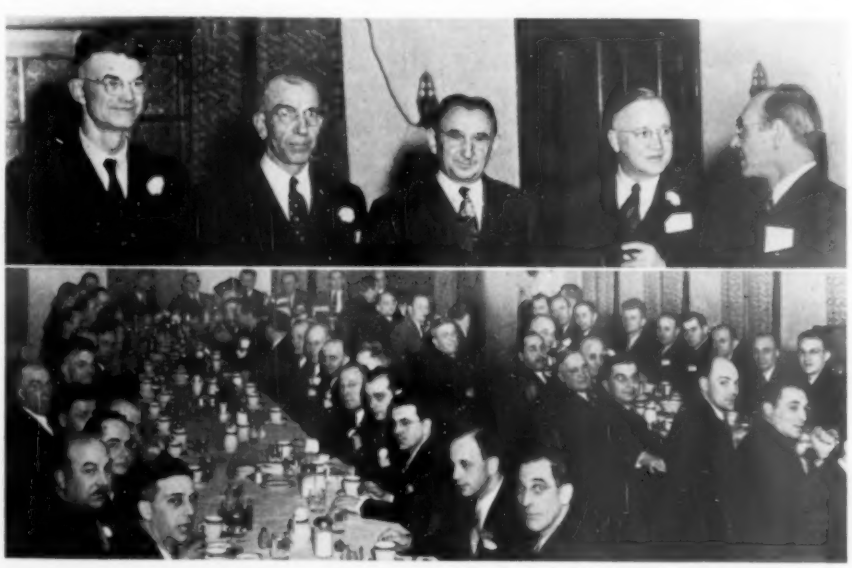
Occasionally the speaker paused to encourage questions from the audience, before proceeding to the more complicated phases of his talk.

His slide-illustrated lecture also included a discussion of checking surfaces for contour with optical flats, the standard meter in terms of wave lengths of light, and the checking of gage blocks.

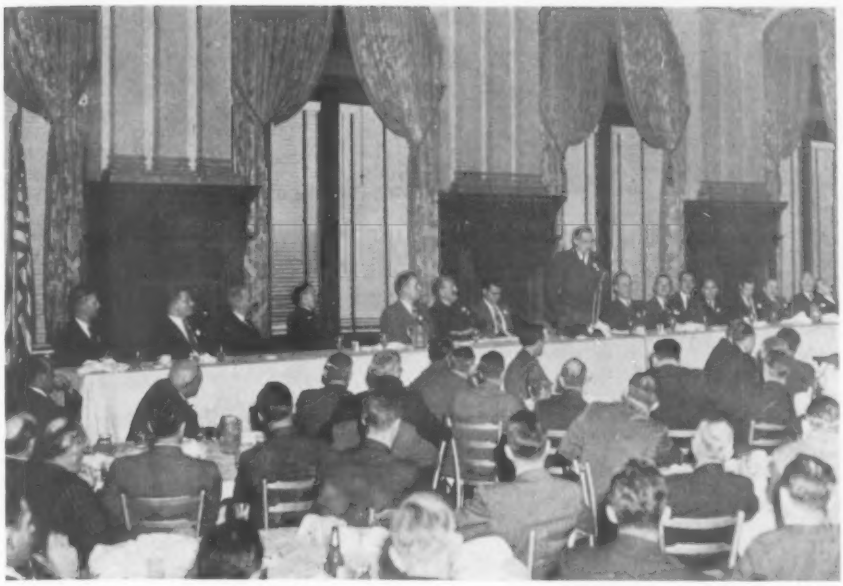
Mr. Gabriel's excellent presentation made his difficult subject very clear to engineers interested in close measurements. He is affiliated with Chicago Chapter, ASTE.

One hundred and twenty members and guests attended the dinner meeting.

Your Red Cross Must Carry On



Several members of Flint Chapter gather around Adam Gabriel of Acme Industrial Co., to ask technical questions. Mr. Gabriel, a fellow ASTE'er, spoke on "Light Waves and Their Use in Precision Shop Measurements" January 17 when the Chapter met at Herman Fischer's Hotel in Frankenmuth. Left to right are: Earl C. Baldwin, President, and Carl E. Shanks (a guest), Vice-President, Flushing Machine Tool Co., Flushing, Mich.; Mr. Gabriel, Oscar L. Strand, Tool Supervisor, Buick Motor Division; and Clyde L. Fanning, Technical Instructor, General Motors Institute, Flint. Below are some of the 120 members and guests who attended the dinner meeting.



President C. V. Briner expresses his appreciation of the recognition conferred on him by his fellow Chapter members on "Briner Night," February 8. More than 200 ASTE'ers and guests attended the Hotel Hollenden testimonial dinner. Shown at the speakers' table are, left to right: K. M. Meyer, Past Chairman; H. E. Peiffer, Treasurer; John Love, Cleveland Press columnist; W. J. Frederick, National Treasurer; E. W. Baumgardner, Second Vice-Chairman; W. B. Peirce, Second Vice-President; J. I. Karash, Chapter Chairman; Mr. Briner (standing), A. M. Sargent, First Vice-President; R. E. Harrold, Chairman-Elect; R. Y. Moss, the Sheffield Corporation, technical speaker; T. P. Orchard, Third Vice-President; W. H. Fitzsimmons, Chapter Secretary; A. M. Schmit, National Secretary; Charles Schiehing, and William Reiff, Jr., Past Chapter Chairmen.

Bach Details Methods of Surface Hardening

Boston, Mass.—Technical speaker for the January 10 meeting of Boston Chapter was A. Dudley Bach, President of New England Metallurgical Corporation and the Greenman Steel Treating Company. Mr. Bach spoke on "Surface Hardening of Steel."

The speaker explained the principle of pack hardening, where parts are packed in a carbonaceous material and heated to about 1600°F. Carbon monoxide is formed and carbon driven into the material to a depth regulated by time.

The parts may be cooled and reheated to the critical temperature for the case, and then quenched; or other cycles may be adopted to obtain a variety of results.

Heating in a retort with carbonaceous gas, Mr. Bach pointed out, will also produce this effect, but the chemistry is relatively the same. A salt bath may also be employed.

Cyanide Bath Hardens

Where depth is not important, he stated, a cyanide bath will give a high superficial hardness. With the addition of ammonia, a sort of nitrided surface is secured.

Mr. Bach discussed the process of nitriding airplane cylinders and the results attained on gun barrels. Generally, a special steel is used with about .50 carbon and 1% aluminum to help absorb the nitrogen.

Great wear resistance is claimed for this method on high carbon and high chrome steels, and to a lesser degree on 4150. Examples were cited where taps, reamers, and dies nitrided to a depth of .00025" were very effective on abrasive materials.

Taps may require 15 minutes and cylinders from 10 to 90 hours, depth of the case being the controlling time element for this process. As the temperature is maintained at 960°-975°F, distortion is held to a minimum, and quenching is unnecessary.

Mr. Bach showed several short films and a profusion of slides, demonstrating many ingenious devices for flame and induction hardening. While making no line of demarcation as to the choice of flame or induction hardening for a particular part, he showed applications of each, to illustrate their merits in individual cases.

Precision Emphasized

The versatility and precise knowledge necessary to turn out consistently high grade work in commercial heat treating was also apparent in the pictures.

Gadget speaker was Harold L. Lundstrom, Chief Engineer, W. H. Nichols & Sons, Waltham. Explaining the design principle, Mr. Lundstrom demonstrated the functioning of a manually-operated fixture for rounding the corners of gear teeth, on a hand milling machine.

A special cutter, approximating the radius at the root of the tooth, is mounted on a vertical head set at an angle. The fixture is designed, he said, so that a rotation very closely approximates the involute curve of the tooth, and the radius of the cutter blends the radius at the root of the tooth. The fixture is indexed rapidly, and the cycle is very short.

To machine the opposite side of the tooth, he continued, the pivot point of the fixture and the angle of the vertical head are changed.

No standard equipment is available for this job which was previously done by hand. The uniformity of the work produced and the speed of the cycle constitute an outstanding example of tool engineering combined with Yankee ingenuity.

"Briner Night" Observed By Home Chapter

Cleveland, Ohio — Highlight of the year's activities for Cleveland Chapter occurred February 8, the occasion being "Briner Night" in honor of ASTE President C. V. Briner, one of their own members.

Over 200 Cleveland Chapter members were present to hear Mr. Briner give a review of the many improvements inaugurated in the Society during his administration, as well as an outline of plans being considered for the future.

Technical speaker was R. Y. Moss, Production Engineer, The Sheffield Corporation, Dayton. Mr. Moss gave a very informative lecture on the history, development and design of precision air gages.

During the evening the following officers were elected to administer the affairs of the Chapter for the coming year: Chairman, R. E. Harrold; First Vice-Chairman, E. W. Baumgardner; Second Vice-Chairman, H. B. Osborne, Jr.; Secretary, H. E. Peiffer; and Treasurer, J. H. Schron.

H. E. Peiffer was elected Delegate to the National assembly, with K. H. Meyer as Alternate.

Stephen Johnston

R. Y. Moss

National Officers present for the event included: First Vice-President A. M. Sargent, Second Vice-President W. B. Peirce, Third Vice-President T. P. Orchard, Secretary A. M. Schmit, and Treasurer W. J. Frederick.

John Love, noted columnist for the *Cleveland Press*, also was a guest.

* * *

Stephen Johnston, of the Bendix-Westinghouse Automotive Air Brake Company, Elyria, Ohio, was the speaker at the technical session of the January 11 meeting.

In his address, "Air-Operated Fixtures," Mr. Johnston thoroughly covered the application of air-actuated clamping devices for increasing the productive capacity of fixtures.

At this meeting Edward Marasko, Standards Chairman; Elmer Richter, Constitution and By-Laws Chairman; and Charles Schiehing, Past Chapter Chairman, were elected to the Nominating Committee, with Mr. Marasko as Chairman.

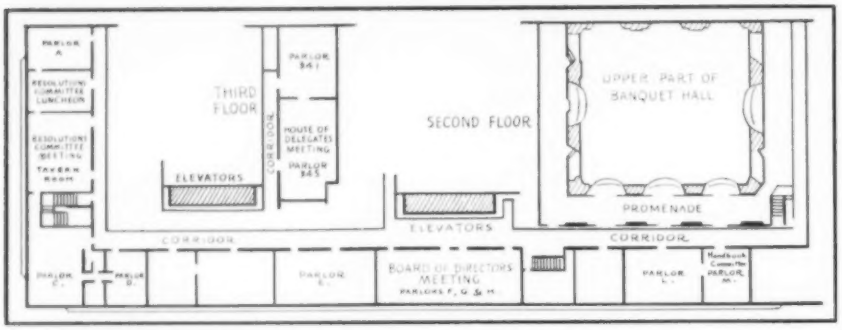
Fun Night

Worcester, Mass.—The Annual Fun Night and Christmas Party of Worcester Chapter was held December 4 at Putnam & Thurston's Restaurant.

Musical selections were rendered by the Mary Laughlin Trio as dinner was being served to the 155 members present.

Entertainment was provided during the evening by a comedian and instrumental duets and trios. Each ASTE'er received a gift.

Ample Facilities Provided for Convention Meetings



Rooms indicated on partial floor plans of the second and third floors of Hotel Statler, Cleveland, will be available for meetings of committees and other bodies during the ASTE National Membership Meeting in that city next month. The Statler will be official headquarters for the convention.

Crush Grinding Reduces Grinding Time One-Half

Minneapolis, Minn.—"Crush Dressing of Grinding Wheels" was the technical subject for the January 16 meeting of Twin Cities Chapter, held at Dunwoody Industrial Institute. Joseph Kingman, Director of the Institute, welcomed the Chapter and extended an invitation for future meetings.

Carl J. Linxweiler, Manager of Tool Distribution, and his associate, John Welsh, of Sheffield Corporation, Dayton, Ohio, were the technical speakers. Their subject, "Crush Dressing," was to most of the 65 members and guests "a new wrinkle in wheel dressing."

Mr. Linxweiler briefed the history of crush dressing, and explained how his company pioneered in America the first commercial use of this process for producing circular forms and threads, one of the notable manufacturing accomplishments of World War II.

Spindle design, crushing cycle, and the three types of dressing fixtures used, namely — idler, motorized — ideal type, and motorized — integral head unit — were slide-illustrated and explained in detail by the speaker.

Advantages Numerous

Some of the advantages of crusher roll dressing outlined by Mr. Linxweiler, are: a better cutting surface produced (sharper cutting points); wheel cuts cooler, holds up longer and grinds with approximately one-half the pressure against the work; actual grinding time reduced as much as 50 to 75%, and five to twenty times greater stock removal.

Mr. Welsh completed the discussion with data on a number of sample parts produced by this new wheel dressing process, as well as facts on the crusher roll construction and manufacture. Material used, he said, was high speed steel, contour ground, on "micro-form" grinders. Experiments were also made with carbide rolls which were found too expensive. Stock rolls for U.S.S. and Whitworth (8 to 32 pitch) are available, the speaker stated. Although 48 pitch has been used successfully, it is not recommended, according to Mr. Welsh.

His informative remarks during the question and answer period completed the meeting. More technical subjects of this caliber have been scheduled for the coming year.

Situations Wanted

ENGINEER, specialized in tooling, liaison, and machine design and detail, wishes employment in this field, preferably with engine manufacturer. Application pending on patent for more efficient internal combustion engine. Experience includes 12 years in structural steel; 1 year, reinforced concrete; 2 years, aircraft tooling; 2½ years, machine design; ½ year, marine engineering; ½ year, mechanical experimental engineering; 1½ years, architectural drafting; and 3 years in commercial art and photography. Write Box T, American Society of Tool Engineers, 1666 Penobscot Bldg., Detroit 26, Mich.

FOREMAN, CUTTER GRINDING DEPT.— Navy veteran with 9 years' experience, including 4 years as supervisor of tool and cutter grinding department employing 75 men and women in making and sharpening intricate tools to the highest precision required for aircraft engines; 5 years as tool and die maker for large shoe company.

Extensive experience on all carbides, including taps and reamers, working to the closest tolerances and finest micro-finishes. Prefer Middle West location. Address: Box R, American Society of Tool Engineers, 1666 Penobscot Bldg., Detroit 26, Mich.

JUNIOR TOOL DESIGNER, 26, recently released from military service, desires position in New York City or vicinity. Four years' experience in design, layout and detail on precision parts. Write Box S, American Society of Tool Engineers, 1666 Penobscot Bldg., Detroit 26, Mich.

TOOL ENGINEER — Automobile manufacturing—experienced in estimating and selecting tools and machines, requesting and approving designs necessary in tooling, and writing operation sheets for machining and assembling of automobiles. Prefer Detroit connection, but will go elsewhere. Educational background includes engineering courses at several technical schools. Address: Box Q, American Society of Tool Engineers, 1666 Penobscot Bldg., Detroit 26, Mich.

Annual Election Draws Large Attendance

Fond du Lac, Wis.—More than 100 Fond du Lac Chapter members from eastern Wisconsin cities, met at the Takodah Golf Club, February 8, and elected L. J. Kaufman of Manitowoc, Chairman for the coming year.

Other officers elected were Jule P. Schommer, Oshkosh, First Vice-Chairman; Henry S. Faith, Fond du Lac, Second Vice-Chairman; Aaron N. R. Boynton, Oshkosh, Treasurer; and Don Storms, Manitowoc, Secretary. Mr. Kaufman served as Second Vice-Chairman, and Mr. Schommer as Treasurer during the past year.

The newly-elected Chairman of the local Chapter, which includes members from the Fox River area, will serve as Delegate to the national assembly at Cleveland in April, with E. J. Kaiser of Fond du Lac as Alternate.

Candidates for election were presented by a nominating committee composed of William Felten, Sheboygan; K. F. Gallimore, Fond du Lac; and Arthur Schroeder, Oshkosh.

Members heard Thomas E. Detherow of Bryant Chucking Grinder Company, Springfield, Vt., give a commentary on a colored sound film showing the proper tooling for internal grinding. Possibilities of grinding unusually-shaped tools to very close tolerances, with standard equipment, and the prescribed holding fixtures were also shown and discussed by Mr. Detherow.

More than 40 members from five Fond du Lac plants attended the dinner meeting.

Brierley Named Chairman

Grand Rapids, Mich.—February dinner meeting of Western Michigan Chapter was held on the 11th in the English Room of the Rowe Hotel. Approximately 50 members and guests were present.

C. J. Linxweiler

The business meeting was given over to election of officers and a Delegate. Those elected to Chapter office were: Chairman, James Brierley; Vice-Chairman, Herbert Young; Secretary, Edmund Cederquist; and Treasurer, Newell Fox. Thomas Newby was elected Delegate to the House of Delegates.

The technical program was presented by C. J. Linxweiler of The Sheffield Corporation. Mr. Linxweiler very ably discussed the advantages and limitations of crush dressing of grinding wheels, supplementing the lecture with slides and an exhibit of work done with crush dressed wheels.

The latter part of the meeting was devoted to a discussion period.

* * *

About 40 members and guests attended the January 14 meeting when a program was presented by Messrs. H. F. Wolf, H. A. Steiner, and S. A. Veltman of the Madison Manufacturing Co., Muskegon, Mich., who described adjustable cutters and reamers, and their applications. At the conclusion of their remarks, the speakers answered questions from the floor.

Metal Spinning Conversion Tool

Baltimore, Md.—Many engineers and manufacturers, thoroughly familiar with manufacturing processes and techniques, still regard metal spinning as a mysterious method of forming sheet metal parts, Arnold Hildebrandt, Field Engineer, Milwaukee Metal Spinning Company, told members of Baltimore Chapter at their January 9 meeting. Mr. Hildebrandt gave the technical address of the evening on the subject of "Metal Spinning."

Arnold Hildebrandt

First step in the process, he explained, consists of securing to a lathe a wood or metal form turned to the exact shape and dimensions of the desired finished spinning. A flat metal blank is then clamped to position in front of the form, and both form and metal are revolved at high speed.

The spinner exerts pressure on a long, blunt tool which he deftly controls with arm, hand and torso muscles, flowing the metal snugly over the form.

Wide Range of Sizes

While it is not possible to set definite limitations, spinnings can be produced in sizes ranging from ¼" to at least 12' in diameter.

Though spinning and stamping are commonly regarded as strictly competitive methods of forming, spinning is the more economical means of fabricating in small quantities, while stamping costs less for large-scale production, according to Mr. Hildebrandt.

As an example of the speed with which metal spinning can transform a blueprint dream into a physical reality, the speaker related an incident in maintaining the flow of gasoline into China despite Jap bombing of refueling stations on the Burma Road.

Charcoal-Burning Trucks Used

Solution of this problem involved equipping trucks with charcoal ovens for generating power. There was no time to make dies, but four days after the material was received, Spincraft had completed 71 test samples. At the end of 12 days, several thousand pieces had been shipped.

Competition, Mr. Hildebrandt reminded his listeners, will be keen once the immediate demand for civilian production is satisfied. Metal spinning, he said, offers a means of preparing production lines for this competition, by carrying the load of new metal product development while immediate manufacturing problems have the right-of-way.

Forming by metal spinning, he summarized, is efficient for limited and, in some cases, volume production; for premarket samples, and for re-design and conversion. Many production mistakes, the speaker concluded, can be avoided by evaluating product development in terms of metal spinning.

George W. Keller, of the Maryland Department of Education, spoke on "Rehabilitation of the Blind Through Industry." Totally blind himself, Mr. Keller serves as Rehabilitation Counsellor, specializing in industrial employment for sightless persons.

Instrument Company Head Named Chapter Chairman

Kansas City, Mo.—Amber N. Brunson, President of the Brunson Instrument Company, was elected Chairman of Kansas City Chapter at their annual election of officers February 6, in the Pine Room of the Union Station.

Other officers elected were Fred N. Epperson of Aireon Mfg. Corporation, First Vice-Chairman; Leroy E. Campbell, Benson Mfg. Company, Second Vice-Chairman; George V. Potter, Potter Radio and Electric Company, Secretary; and J. W. Gallagher, Butler Mfg. Company, Treasurer. H. Robert Brown of Aireon Mfg. Company is the retiring Chairman.

W. W. Mason of the Gleaner Harvester Company and Mr. Brown were named as Delegate and Alternate to the National Meeting in Cleveland during the week of April 8.

Immediately after the election, two U. S. Office of Education sound films were shown by Vascoloy-Ramet Corporation, illustrating the latest procedures for brazing carbide tools and grinding single-point carbide tools.

Demonstrating how the work would be done with average shop equipment, the motion pictures depicted the grinding of all the angles and the radius on the tool point by holding the tool manually.

Grinding of the chip breaker relief on the tools was accomplished by clamping the tool in a vise and operating the table of the machine by hand. Leading engineers of the carbide tool industry cooperated in the production of the films.

* * *

January meeting, held on the 10th, featured the technicolor sound film, "Railroading by Radio," presented by the Aireon Manufacturing Corporation, Kansas City, Kansas.

This production tells the story of the engineering and development of radio communication in railroading. Actual operation of trains is shown to visually illustrate the improvements resulting from the use of radio communication.

Coffee speaker was Clay Crone, Director of Public Relations for the Aireon Corporation, who narrated his experiences in a Japanese prison camp.

Mr. Crane, an American citizen, was taken prisoner as a civilian by the Japanese during the fall of Manila in 1942. He gave a colorful description of life as a prisoner of war for the three and a half years until he was liberated by the Americans.

Bryan Elected Chairman

Chicago, Ill.—Officers for 1946-47 were elected by Chicago Chapter members at their February 4 meeting in Huyler's Restaurant. The men elected are: Chairman, Clare Bryan; First Vice-Chairman, Fred Schmitt; Second Vice-Chairman, Harold Taylor; Secretary, Ray Erickson; and Treasurer, Anton Schwister. Fred Schmitt was named Delegate to the National Meeting, with Frank Martindell as Alternate.

The Nominating Committee, presenting the slate of candidates, consisted of: Roy Hoefer, Chairman; Frank Kinkaid, and Clifford Ives.

Chairman Frank Armstrong introduced Creighton Audette, Assistant Sales Manager of Cone Automatic Machine Company, Inc., as the guest speaker for the evening. Through his background as serviceman, tool engineer and sales engineer for one of the leading manufacturers of automatic machines, Mr. Audette is recognized as an authority in this field.

His discussion of the "Development of Automatics" included a history of the Automatic and the men who pioneered its development from its beginning to the present day.

Following his discussion, Mr. Audette presented a technicolor sound film showing Automatics in operation. The pictures revealed the structure and mechanical movements of the various sections of the machines. The progression through the tooling layout, tooling, and operations in the manufacture of various types of parts frequently produced on the Automatic were very clearly depicted.

Jones Lectures On "Vibrations"

Racine, Wis.—One of Racine Chapter's most successful meetings of the season was held February 4 at the Danish Brotherhood Hall with Dr. Hilton Ira Jones, well-known scientist and lecturer, as principal speaker of the evening.

After dinner A. P. Nelson, Chapter Chairman, introduced P. K. Povlson, Vice-President in Charge of Production at J. I. Case Co., as Toastmaster.

Dr. Jones, the guest speaker, chose the subject of "Vibrations" as a sequel to his talk last year before the Chapter. He gave a vivid word picture of what science is doing, and of the important role vibration will play in the future.

Chaplin Larson, who saw service in the Pacific area with the 4th Marines, was introduced during the evening.

P. K. Povlson of J. I. Case Co., Toastmaster at February 4 meeting of Racine Chapter, opens the evening's program. At his right is Dr. H. I. Jones, scientist and lecturer, who spoke on "Vibrations." Chaplin Larson of the 4th Marines and Chapter Chairman A. P. Nelson sit at his left. Group at the right is enjoying Dr. Jones' presentation.

Obituaries–

John W. Younger

In the recent death of John W. Younger, Chairman, Department of Industrial Engineering at Ohio State University, Columbus, Ohio, the Society sustained the loss of one of its most distinguished members.

J. W. Younger

Although Professor Younger had been in poor health for several years, death came suddenly from a cerebral hemorrhage suffered as he was preparing to go to school to meet with his classes.

In the Society he held the unique distinction of being the first of the three men elected to Honorary Membership, receiving this recognition in 1935. While he had been affiliated with Columbus Chapter since its inception, modesty prevented his accepting offices in that group. "I have a feeling that this is a young man's society and that young men should do the work," he said.

He was appointed Chairman of the ASTE National Education Committee Sub-Committee on College Curricula, serving in this capacity until ill health made it necessary for him to resign.

Another accomplishment was the published report of the ASTE Fact Finding Committee which he chairmanned. This group, composed of outstanding industrial executives, writers, and educators, made an exhaustive survey of the effect of machines on employment. Many technical journals published articles concerning their findings.

Professor Younger was also a long-standing member of ASME.

Born in Scotland in 1882, he was graduated from Glasgow University in 1903. His first industrial job was as apprentice mechanic in the Glasgow Locomotive Shops. He left this work to become Work Shop Training Supervisor at the Woolwich Arsenal in England. There he was introduced to the design of jigs, tools and fixtures.

His next position was as Chief Tool Engineer for the Johnston Motor Car Company of Paisley, Scotland. Later he became Assistant Chief Manager for Dennis Bros., Ltd., motor truck manufacturers in Guildford, England.

In 1910 he came to the United States to accept the post of Chief Engineer for the Pierce-Arrow Motor Car Company, Truck Division. During World War I he was Chief of the Engineering Division, U. S. Motor Transport Corps.

A connection with Standard Steel Car Company, as General Manager of Standard Parts, preceded his acceptance of the Chair in Industrial Engineering at Ohio State University where he was a popular teacher.

He received many honors, including the Distinguished Service Medal, Tau Beta Pi and Sigma Xi.

Roland Nauertz

Roland Nauertz, 36, of Cutler-Hammer, Inc., Milwaukee, Wis., died suddenly on January 26 after being stricken with a cerebral hemorrhage. His passing came as a distinct shock to his fellow ASTE'ers in Milwaukee Chapter as he had had no previous serious illness.

Roland Nauertz

Mr. Nauertz was born in Milwaukee and educated in the schools of that city. In 1926 he entered the employ of Cutler-Hammer as an apprentice toolmaker, subsequently becoming a full-fledged toolmaker. Promotion to Tool Engineer came in 1935 when he was assigned to the AC Automatic and Manual Starter Group.

After several years of general assignments in this department, he was placed in charge of all its tool and manufacturing problems. He was serving in this capacity at the time of his demise.

Mr. Nauertz became affiliated with ASTE shortly after the organization of Milwaukee Chapter in which he was very active.

He had served two terms as Chapter Treasurer, one as Secretary, and was the incumbent First Vice-Chairman.

Coming Meetings

CLEVELAND—April 6-7, Annual Meeting, Board of Directors, Hotel Statler. April 8-12, National Membership Meeting, Hotel Statler; New Era Exposition, Public Auditorium.
April 10, 10:00 A.M., National Education Committee Meeting, Tavern Room, Hotel Statler.
April 11, 7:30 P.M., Annual Dinner, Grand Ballroom, Hotel Statler.

DAYTON — April 8. Dinner meeting, Engineers Club. Speaker and film sponsored by Bryant Chucking Grinder Co. Subject: "Tooling for Better Internal Grinding."

NEW HAVEN—April 11, Chi Psi House. Dinner, 6:30 P.M.; Technical Session, 8:00 P.M. Speaker: K. R. Herman, Vice-President and General Manager, Vickers, Inc., Detroit, Mich. Subject: "New Developments in Hydraulic Transmission of Power."

TORONTO—April 8, Malloney's Art Gallery. Dinner, 6:30 P.M. Speaker: Otto Weitman, Lepel High Frequency Laboratories, Inc., New York City. Subject to be announced.

'Goldberg' Gadgets Amuse 'Ladies' Night' Audience

South Bend, Ind.—The annual Ladies' Night dinner meeting of South Bend Chapter was held in January at the Indiana Club, with 150 members and guests present.

After dinner an interlude of music was presented by Ethel Stuart Gaumer and her philharmonic singers.

Highlight of the evening's entertainment was "Professor" Russel E. Oakes, Goofy Gadget Genius, who delighted the audience with his "Rube Goldberg" creations which ranged from a noiseless soup spoon to a hydraulic, pneumonic, rat-powered, never-fail cigarette lighter.

Crush Grinding Simple When Properly Done

Toronto, Ont.—J. C. Wilson, Chief Engineer and Sales Manager, Thompson Grinder Company, Springfield, Ohio, gave the technical address at the January 14 meeting of Toronto Chapter. His subject was "Crush Form Grinding."

J. C. Wilson

Mr. Wilson made it clear that this process is not a new technique as many apparently believe, and that it is a comparatively simple one if the basic rules are observed.

He outlined the manufacture of crusher rolls, explained methods of crushing, and emphasized that the machine spindle must be rigid.

His statement that straight wall grinding is quite possible with crush form grinding created considerable interest and evoked many questions.

Actual methods illustrated on the screen showed a variety of intricate work being ground, with production figures.

At the conclusion of his address, the speaker ably answered many questions from an extremely interested audience.

Many were attracted from outlying towns, despite severe weather, the attendance proving that crush form grinding is a very timely topic.

Ballots were cast for the instruction of the Chapter Delegate in the election of Directors at the Annual Meeting of the House of Delegates. Past Chairman James McRae, Fred Schytte, and Norman Wearn were elected to the Nominating Committee.

National Director R. B. Douglas of Montreal extended official greetings from Montreal Chapter and presented Herbert Gibson, formerly of that city, with a gift in appreciation of his work in the organization and development of Montreal Chapter.

During the coffee hour an interesting Kodachrome, sound film was shown, explaining the "Use and Abuse of Hacksaw Blades."

Johnson Elevated To Presidency

Dayton, Ohio—Earl V. Johnson, who recently joined The Dayton Carbide Tool Company as Director of Sales, has been elected President of that concern.

E. V. Johnson

For the past ten years, Mr. Johnson has been associated with Firth-Sterling Steel Company, specializing in the engineering of sintered carbide applications. Earlier, he served for several years in a sales and editorial capacity with McGraw-Hill Publishing Company. From 1916-28 he held engineering posts with Western Electric Company, Chicago.

A member of Dayton Chapter, ASTE, Mr. Johnson is a former Director and past National Secretary of the Society.

Author Describes Engineered ASTE Show Dinner

Detroit, Mich.—Engineering and prefabrication, in addition to culinary "know-how," were important to the success of the dinner served to the Society during the 1941 Machine and Tool Progress Exhibition, according to a recent article in *The Detroit News*.

The story, one of a series, entitled, "50 Years of Good Eating," was written by Stella V. Hough, former manager of the Woman's Exchange. The Exchange, which closed during the war years when the food situation became difficult, was noted for a half-century of catering to Detroit's most elaborate private and public social functions.

"No one would choose Convention Hall," the author begins, "as an ideal place in which to cook and serve a dinner, not only because it is a place of magnificent distances, but also because normally, it has no cooking facilities at all.

"But the Exchange did manage that feat, some years ago, with a dinner for 300 engineers. The occasion was a meeting of the American Society of Tool Engineers on March 24, 1941."

Wrote Operation Sheets

"Looking back over the records at this time, it occurs to us that perhaps the secret of carrying out this rather difficult sort of undertaking without confusion lay in the carefully written directions for every detail. This was common practice with the Exchange as it probably is with every successful business of this kind . . .

"On this occasion the planning even included making special arrangements for gas, water, the renting of ranges, aside from all the usual appointments for a dinner. The preliminary preparation of the food was done at the Exchange, but the actual cooking was done at the hall.

"The written directions in this particular case paid big dividends because when the day came to serve the dinner, the manager was several hundred miles away in a hospital, but the splendid staff at the Exchange carried right on without a hitch."

The menu which, Miss Hough points out, was planned to please the men, included delicacies long since vanished. Members who partook of this repast will recall these gustatory delights:

Fresh California
Crab Lumps Ravigote
Bouillon

Relishes **Breadsticks**

Roast Beef—New York Cut,
Pan Gravy
Fresh Mushrooms Saute
Roasted Browned Potatoes
Fresh Asparagus Loaf with
Hollandaise Sauce
Shredded Green Beans
Hot Fresh Beets Pickled
Assorted Rolls
Tossed Green Salad with
Jones Dressing
Individual Ice Cream Forms
Monogrammed Fancy Cakes
Coffee

"Fresh crab lumps," the best portions, taken from the back fin of the crab, Miss Hough hastens to explain, are no longer available. "New York cut" is described as "the choicest part of the sirloin."

The article concludes with recipes for some of the dishes and details concerning their preparation for the ASTE banquet.

Cahill Now Manager IBM Tool Analysis

Endicott, N. Y.—James E. Cahill has been appointed Manager of the Tool Analysis Department, International Business Machines Corporation.

J. E. Cahill

Born in Scranton, Pennsylvania, Mr. Cahill was educated in the Elmira schools and served his apprenticeship with the Eclipse Manufacturing Company.

He first became associated with I.B.M. in 1930, as a toolmaker, subsequently being promoted to Tool Inspector, and Tool Analyzer, the post he held until his recent promotion.

Prior to joining I.B.M., he was employed at Timken Roller Bearing Company, Columbus, Ohio; North East Electric Company, Eastman Kodak Company, and Ritter Dental Manufacturing Company, all of Rochester, New York.

Mr. Cahill is a member of Binghamton Chapter, ASTE, the I.B.M. Country Club and the I.B.M. Study Club.

Staples to Be Grown For Waste Products

Chicago, Ill.—Science has discovered more uses for corncobs and cottonseed than for corn and cotton, Dr. Hilton Ira Jones, distinguished scientist and lecturer, declared in his address, "Peeps at Things to Come," delivered January 7 before Chicago Chapter.

Dr. H. I. Jones

In the future, he asserted, these agricultural products will be grown for the portions which were formerly considered waste. Cottonseed oil, soaps, dyes and fuel are some of the by-products made from these two staples.

Of interest to the ladies in the audience was Dr. Jones' statement that, in the future, nylon hosiery will be better, cheaper, and more plentiful. This superior hose, he explained, would need only to be snapped briskly after washing to be dry and ready for wear.

Other chemical wonders described by Dr. Jones included beautiful dress fabrics made of spun glass, unbreakable glass that transmits ultra-violet rays from the sun, air-bubble plastic seat cushions and mattresses, house insulation, and blankets warmer and lighter than woolen ones.

Research chemists, he added, have also produced a water-proofing gas to be sprayed over clothing, a permanent starch, a spray liquid to keep garments in press for long periods, a solution to preserve dead animal and vegetable matter for 10,000 years, oil made from silica, outlasting the automobile in which it is used, silica wire insulation that withstands tremendous heat, and a pineapple powder to tenderize tough meat.

In closing, Dr. Jones commented that greater achievements would be possible with cooperation between scientists and engineers.

Taxes Curb New Industry Flanders Tells NTDMA

Hartford, Conn. — The deadening pressure of high taxes in retarding the development of new industry, while aiding the growth of corporations, was deplored by ASTE'er Ralph E. Flanders, speaking before the second annual New England Conference of the National Tool and Die Manufacturers Association, held at Hotel Bond, January 25.

R. E. Flanders

Mr. Flanders, who is President of Jones & Lamson Machine Co., and Bryant Chucking Grinder Co., of Springfield, Vt., and currently-retiring President of the Federal Reserve Bank of Boston, declared that taxes have removed the possibility of adequate return on new undertakings, discouraging possible investors.

Paralleling this trend, he pointed out, is a tendency for large corporations to accept new ideas and encourage development, because losses can be written off against taxes, and profits added to corporation assets.

"The result," Mr. Flanders said, "is not in the public interest. A great release of energy comes when a small group of men go out on their own. New ideas are stimulated as they would not be otherwise. In the machine tool industry, particularly, we have drawn upon the vitality and energy of the small businessman."

Mr. Flanders proposed the release of a fraction of the national fiduciary funds, which in New England alone reaches an estimated $10,000,000,000, to pump lifeblood into new and small businesses.

He cited as a model for this suggestion a Connecticut law, passed by the Legislature in 1945, which removes legal limitations from the character of investments of 5% of the admitted assets of life insurance companies.

Governor Raymond E. Baldwin of Connecticut, another speaker, told of the work being done in this State to encourage apprenticeship training for the machine and tool industries. "We changed the name from 'trade schools' to 'technical schools'," he said, "because we found that under the former name they had become 'dead end' schools. We also broadened the curriculum, and the result has been an increase in the number of students seeking admission."

Other ASTE members who were speakers included Edgar C. Lundeberg, of Lundeberg Engineering Co., Hartford, Conference Chairman; and George S. Eaton, of Cleveland, Executive Secretary of NTDMA.

Holiday Party

New Haven, Conn.—Group singing, led by Entertainment Chairman George F. Westerman and accompanied by Charles Morse at the piano, opened New Haven Chapter's Christmas Party, held December 13 at Chi Psi House.

Dinner was followed with a selection by the ASTE quartette and a showing of films.

After the members had participated in a program of games, prizes were awarded. The party concluded with the distribution of gifts by "Santa Claus."

Fluid Motors Adaptable to Industrial Uses

Philadelphia, Pa.—Fluid motors—used militarily on tank turrets and bombers—will find many peacetime industrial applications in the opinion of Rupert P. Esser, Ass't General Manager and Chief Engineer, Gerotor May Corporation, Logansport, Ind., and technical speaker appearing before Philadelphia Chapter January 17.

These motors, Mr. Esser explained in his address, "General Principles of Industrial Hydraulics," are excellent for timing operations on index tables, rotary tables and continuous press operations.

In outlining the theory of hydraulics, Mr. Esser first drew a comparison between industrial hydraulics and the lighter aircraft type. Contrasting water and oil types, he recommended the former where fire hazards exist and where equipment is suitable, pointing out that the oil installation gives much longer service.

Throughout his discussion, he stressed the importance of using the best available hydraulic oils.

Explaining the various kinds of pumps such as centrifugal versus positive displacement, the speaker indicated that expensive parts and maintenance problems enter into consideration of the variable displacement pump. A constant delivery pump, on the other hand, is inexpensive and may be of a straight or helical gear type.

Many Types of Valves

Valves, described by Mr. Esser, included four-way, plug, poppet, hand, foot, solenoid, cam roller, pressure control, relief, and pressure-regulating types.

Steel tubing he advocated for all hydraulic installations, cautioning that complete details of the proposed job should be furnished the equipment dealer.

Mr. Esser's answers to questions in the subsequent discussion period indicated that the mechanical efficiency of the hydraulic pump varies from 60% at one gallon per minute to 80-90% at 30 gallons per minute; and that pressures as high as 1000 lbs. in service and 1500 lbs. in test are possible, although a pressure of 750 lbs. is recommended to prolong the life of the equipment.

Major E. W. Lafferty, a Chapter member who recently completed a two-year assignment assisting the Chinese ordnance department to become more self-sufficient, spoke on "Chinese War Production."

Arsenal Center Remote

Chungking, he said, was chosen as the Chinese arsenal center because of its fog-shrouded situation 1500 miles from the coast. Despite this sheltered location, it was one of the most-bombed cities in the world. Some industries were conducted from the security of caves in the coal-and-iron-yielding Himalayas surrounding Chungking.

Machinery in the Chinese arsenals was old, he observed, but of good, prewar German quality. Both steel mills and foundries were in operation, but while foundry practice was excellent, the coal available was poor in quality, he noted. Their one copper smelter, of 8000 tons capacity, is sufficient for Chinese requirements, he added.

Ordnance production included 60mm. and 82mm. mortar shells, artillery and small arms ammunition. Being clever with their hands, the Chinese make good mechanics, tool, die and gauge makers, but poor foremen.

Subject to strafing by Jap planes, factory equipment was pulled upstream in junks by manpower, against a 12-mile current. Difficulty and hardships suffered in moving these plants made them the most expensive in the world, Major Lafferty declared.

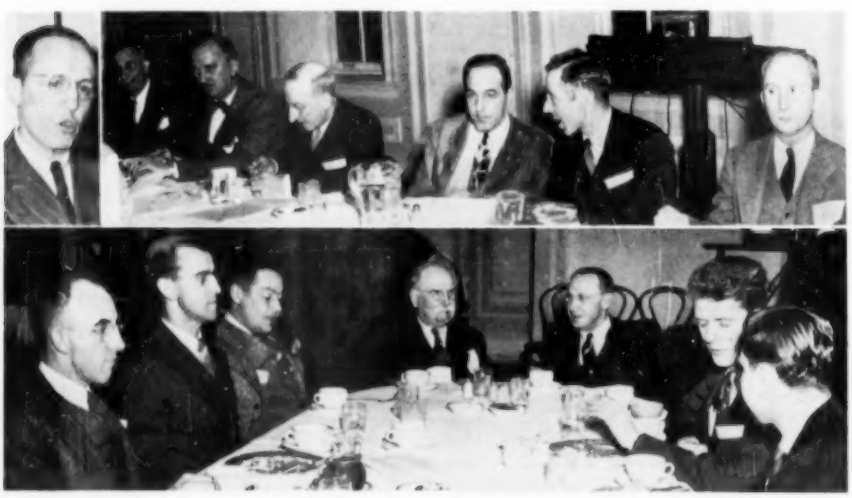
China has 47 technical schools, 40 colleges, several universities, and many doctors of science, he recalled. Despite enemy destruction of schools, education continued. With 50 million literate English-speaking Chinese, necessity for using an interpreter was rare, he found.

One-fourth of the tonnage flown over the "hump" was in Chinese currency, inflation being about 1000 to one of U. S. currency, Major Lafferty remarked.

Lacking in good roads and power, China will develop agriculturally rather than industrially, in his opinion.

A showing of "The Formica Story," a sound film in color, concluded the program.

Dinner was served to 80 at the Engineers Club, attendance at the technical session increasing to 130.



Rupert P. Esser (upper left) explains the "Principles of Industrial Hydraulics" to Philadelphia Chapter members at January 17 meeting in the Engineers Club. Speakers' table group includes (left to right) Chairman John W. Noble, Major E. W. Lafferty, coffee speaker; First Vice-Chairman Howard W. Gross, Reception Chairman Samuel R. Boyer, Standards Chairman Leonard S. Subber and Membership Chairman Arthur R. Diamond. Below, an interesting discussion is in progress at one of the dinner tables.

Anticipates Great Future For Magnesium Alloys

Baltimore, Md.—E. S. Bunn, Metallurgical Manager of the Magnesium-Aluminum Division, Revere Copper and Brass, Inc., presented a talk on "Wrought Magnesium Alloys, Properties, Fabrication and Design," before Baltimore Chapter at a meeting held February 6 in the Engineers Club.

E. S. Bunn

Mr. Bunn outlined the physical and mechanical properties, and methods of fabrication for five magnesium alloys fabricated in sheets, plate, extruded tubes, bars and shapes.

His remarks included an explanation of welding, fusion and resistance, deep drawing and forming, spinning and impact extrusion, machining, corrosion resistance and surface protection schedules.

Magnesium Alloys Superior

Magnesium alloys, the speaker indicated, possess properties and characteristics which make them the outstanding engineering alloys of today. Qualities listed by Mr. Bunn as auguring well for the future of these metals are: lightness, superior machinability, excellent welding characteristics, high absorption of shock or energy loads, great damping capacity, mechanical properties approaching those of mild steel, and their ability to be deep drawn more in a single step than any of the other common metals and alloys.

In most cases, he said, where magnesium alloys are used, either for a new application or as a replacement for a heavier metal, such uses are predicated on the value resulting from a saving in weight. Magnesium alloys are specified, in some instances, because their characteristics may make it possible to produce a unit at a lower cost in spite of a generally higher material cost, he concluded.

Film Shows Operations

Presentation of the film, "The Working of Magnesium," sponsored by the Dow Chemical Company, completed the technical program.

During the business meeting, the following Chapter officers were elected to serve during the '46-'47 season: Chairman, William D. Winger, The L. A. Benson Co., Inc.; First Vice-Chairman, Kurt H. George, Federal Tin Co.; Second Vice-Chairman, Thomas F. Burke, Continental Can Co.; Secretary, Harold G. Suiter, Chase Tool & Engineering Co.; and Treasurer, Clarence E. Hand, Western Electric Co.

Carbon Production Dramatized in Film

New Orleans, La.—Approximately 80 members and guests of New Orleans Chapter saw the film, "Carbon—Black Treasure," sponsored by the National Carbon Company, at a recent Chapter meeting in St. Charles Hotel.

The film, in Kodachrome, is a sound production portraying the story of the engineering research and development of carbon as an irreplaceable industrial tool.

Ancients First Used Precision Casting

Newark, N. J.—Relatively new in industry, the technique of precision casting is actually ancient in origin, and also was used by Benvenuto Cellini in the 16th century, according to Albert W. Merrick, Chief of Research, Austenal Laboratories, Inc., New York City, who spoke before the members of Northern New Jersey Chapter on January 8 at Hotel Robert Treat.

Pointing out that precision casting does not have universal application, Mr. Merrick stated that it is used most widely where no other method of manufacture is practical. For many years this process has been employed for making jewelry and dental plates.

Replaces Difficult Machining

Parts such as supercharger buckets, made of high temperature-resistant alloys inadaptable to machining, are successfully produced by precision casting, he said.

This casting procedure, the speaker related, also may be applied when difficulties in forging or machining make it more economical, even though service factors do not dictate the use of this method.

In the manufacture of samples and first production runs, it is a time saver, cutting processing time to approximately two weeks in most cases, he stated. Design changes, moreover, can be made at much less expense than if forging dies must be altered. In some instances, precision casting is cheaper, especially in producing a few parts.

Size Limited

There are certain practical limits, Mr. Merrick stressed, governing the maximum size of precision castings. At present a ten-pound casting is the approximate limit. While larger castings have been made, he said, they could not be considered entirely successful.

There is, however, no limit to the materials utilized, which may include stainless steel, stellite, die steels and high-temperature alloys, as well as bronzes, brass, and aluminum alloys. In general, he indicated, the higher the alloy, the better the casting.

Some misconception seems to have arisen concerning the precision attainable, Mr. Merrick explained. While limits of plus or minus .001" are possible, they are not considered practical. Usually limits should not exceed ½% of the specified size, with a minimum of plus or minus .003".

Material Cost Inconsequential

Costs, he emphasized, are dependent on many factors, but these necessarily increase with the closeness of the limits and with the number of inspections. The material itself, he claimed, has little bearing on costs, as the use of an expensive metal such as stainless steel often results in a final lower cost through the elimination of later finishing and painting operations.

Many of the 150 members and guests who attended the meeting participated in the lively discussion which followed Mr. Merrick's talk. The accuracy and intricacy of the casting samples on display aroused much interest and comment. Lantern slides were shown during the talk to illustrate the technique of precision casting.

Philadelphia Chapter made merry at Christmas party staged December 20 in the Engineers Club. Sociability and good fellowship are apparent in these views of the general gathering, part of the speakers' table, and the entertainers. Capacity crowd enjoyed the fun. Program included the showing of a film, "The Manufacture of Lamination Dies."

Sixth Dinner Dance Midwinter Event

New York City—Sixth Annual Dinner Dance, sponsored by Greater New York Chapter, was held January 26 in the Grand Ballroom of the Hotel New Yorker.

Julius Schoen

A splendid program of entertainment combined with good dance music and an excellent dinner to make the social function a pleasant one.

Julius Schoen, Entertainment Chairman, and his committee directed the successful affair.

Joins Supply House

Baltimore, Md.—William D. Winger, formerly associated with Koppers Company, Inc., American Hammered Piston Ring Division, has recently joined the sales organization of The L. A. Benson Company, Inc., a well-known industrial supply house in this city.

W. D. Winger

Mr. Winger was connected with the Koppers concern for 23 years, 20 of which were spent in the manufacturing departments of the piston ring division.

For many years he was Chief Inspector, then Superintendent of the Machine Shops for seven years. Since 1942 he has been Assistant to the Works Manager, associated with the Industrial Relations Department.

In his new position, he will represent the Benson company in the field of general industrial supplies.

Mr. Winger serves as Chairman of the Publicity Committee of Baltimore Chapter, ASTE, and is Chapter Chairman-Elect. He is also Vice-President of the Industrial Club of Baltimore, affiliated with the National Council of Foremen's Clubs.

Gas Injection Principle Compared to Carburetion

Springfield, Mass.—Principles of gas injection as opposed to carburetion in the internal combustion engine were explained by Howard Margerum, Field Engineer with American Bosch Corporation, in an address before Springfield Chapter members, February 11, at Hotel Highland.

The two-stroke cycle engine, heretofore impractical, will now come into its own through the gas injection principle, Mr. Margerum asserted.

Overcomes Obstacles

"Disadvantages of this type engine disappear with application of gas injection," he said. The more even and nicely-regulated flow of gas to each cylinder, obtained with gas injection, gives it advantage over the carburetor, he pointed out.

Supercharging also can be utilized to the fullest extent with gas injection as compared with the difficulties arising in supercharging with carburetion.

The gas is preheated in this system, Mr. Margerum stated, reaching a vaporizing point much more rapidly than with the carburetor. The gas is supplied directly to the cylinder chamber where combustion occurs.

Drawbacks to the gas injection system enumerated by the speaker included high initial cost, greater complexity, and slightly higher maintenance.

New Officers Elected

Officers chosen in the annual election were: Chairman, Charles H. Stonerod, Field Representative, E. F. Houghton Company; First Vice-Chairman, Alexander W. Todd, Chief Engineer, Van Norman Company; Second Vice-Chairman, George R. Brown, Superintendent, American Bosch Corp.; Treasurer, Wendell T. Ingham, Engineer, National Blank Book Company; and Secretary, Daniel B. Wesson of Smith & Wesson.

Carl G. Rising, Superintendent of National Blank Book Company, was elected Delegate to the National Convention to be held April 6 in Cleveland. Richard S. Carroll, President, Stacy Machine Works, was elected Alternate.

Four gaging and quality control specialists served as a Board to answer questions submitted by Rochester Chapter members during a forum on these subjects, conducted at the January 9 meeting. Left to right are: C. W. Kennedy, Manager, Quality Control, Federal Products Corp.; M. B. Moore, Executive Engineer, Graflex, Inc.; First Vice-Chairman Charles E. Seely, who acted as Moderator; Halsey Kent, Department Head, Quality Control, Eastman Kodak Camera Works; and Chauncey G. Newton, Rochester Manager, Pratt & Whitney, Div. Niles-Bement-Pond Co.

Dr. Hilton Ira Jones, speaking February 6 before Rochester Chapter, displays samples of products evolved from scientific discoveries. At the right a group hovers around Dr. Jones to discuss the new developments described in his lecture.

Science To Ease Life With New Discoveries

Rochester, N. Y.—A preview of some of the wonders science has in store for the world of tomorrow was given Rochester Chapter, ASTE, and the Superintendents and Production Managers Group of the Industrial Management Council at a joint meeting February 6 in the Chamber of Commerce.

Dr. Hilton Ira Jones, Director of Hizone Laboratories, Wilmette, Ill., brought "Peeps at Things to Come" to the 300 members and guests of the two organizations present at the dinner meeting. Before introducing his subject, Dr. Jones conveyed greetings and good wishes from Racine Chapter, ASTE, where he had spoken on the previous evening.

Dr. Jones' collection of samples of products made from new discoveries ranged from glass fabric to a mosquito repellent that doubles as a hair pomade. He also displayed and discussed flexible plastic water piping indestructible from freezing, a fine abrasive used in solution to keep trousers permanently pressed and hosiery run proof. The same powdered rock is used to drill teeth painlessly, he said.

New plastics so transparent that they admit 98% of the sun's ultra violet rays. Nylon hosiery that needs no drying after washing, tempered glass springs for inexpensive watches, and pendulums of material that does not expand and contract with extremes of temperature were among the new products described.

A revolutionary three-horsepower motor that fits into a coat pocket has been built by engineers working with new materials, Dr. Jones revealed.

In a recent test, one of these motors was run 500 hours at full load in a temperature of 500° centigrade without showing appreciable wear, he said.

Dr. Jones concluded by asserting that business and science must cooperate if the discoveries of the researchers are to be speedily converted into consumer goods.

President Honored By Illinois Group

Decatur, Ill.—A dinner meeting February 11 at the Decatur Club for the officers of Decatur Chapter and President C. V. Briner preceded the monthly Chapter meeting in the "Ration Club" Rooms of the Decatur Pump Company.

C. V. Briner

Technical feature was a lecture by J. A. Gallaher, District Manager, Haynes Stellite Co., Chicago. Mr. Gallaher spoke on "Industrial Applications of Precision Castings."

Mr. Briner, the guest of honor, gave a brief but inspiring talk concerning the future of the Society.

Several new members were introduced and refreshments were served at the conclusion of the meeting.

Crush Form Grinding Credited to British

St. Catharines, Ont.—America is indebted to the British for developments in crush form grinding, Clarence S. Smith of the Norton Company informed members of Niagara District Chapter at their January 18 meeting.

"This technique had been tried out in America as early as 25 years ago," said the speaker, "but was not widely adopted until the British revived interest through their work on crush-forming multiple-start thread grinding wheels."

Referring to new grinding machines now appearing on the market, Mr. Smith gave an insight into newly-developed high production grinding techniques.

In the ensuing quiz period several production executives aired questions pertaining to their own grinding problems.

Gaging, Quality Control Dual Forum Subjects

Rochester, N. Y. — An unrehearsed "Forum on Gaging and Quality Control" constituted the January 9 technical session conducted by Rochester Chapter at Rochester Institute of Technology. The program was arranged as the result of an earlier poll of the membership, indicating high interest in these subjects.

First Vice-Chairman Charles E. Seely, served as Moderator, with a Board of four Rochester men answering the questions submitted. This Board consisted of Halsey Kent, Department Head, Quality Control, Eastman Kodak Camera Works; C. W. Kennedy, Manager, Quality Control, Federal Products Corporation; M. B. Moore, Executive Engineer, Graflex, Inc.; and Chauncey G. Newton, Rochester Manager, Pratt & Whitney, Division Niles-Bement-Pond Company.

Discrepancy Questioned

An inquiry concerning the discrepancy between an air gage and a master metal gage, being used to check the same piece, brought the reply that, if both gages were correctly made and handled, there should be no variation.

Maximum clearance for the air plunger in an air gage was set at .002" to avoid excessive use of compressed air.

The answer to a question, pertaining to the relative merits of ring and roll gages in checking threads, indicated that discrepancies in a thread were more apparent when a roll gage was used.

Through a discussion on the gaging of spur and bevel gears, it was brought out that there should be a standard system for checking bevel gears, similar to the methods used on spur gears.

Need Optical Thread Standards

It was also made evident that there is need for a set of standards on optical threads, which are frequently used for exact location and must be assembled freely, but without shake. This contingency is not covered in U. S. Screw Commission Standards.

For satisfactory threads on purchased parts, emphasis was placed on the necessity of specifying on the order the exact method to be employed in gaging the parts.

Two schools of thought prevailed, concerning the Quality Control Engineer's place in an organization, some members feeling that he should function under the Chief Engineer, while others contended that his duties fall under the supervision of the Chief Inspector.

Enthusiasm for the forum ran high, the Board being occupied for two and a half hours, discussing the problems presented by the audience of 125 members and guests.

Notice ASTE Members

Difficulty in securing delivery of 1946 Membership Cards has delayed National Headquarters in issuing them to members. When the cards are received from the printer, they will be mailed in acknowledgment of the current year's dues.

Metallurgist Makes Return Appearance

Cincinnati, Ohio—For their February 12 meeting, Cincinnati Chapter was fortunate in having Howard J. Stagg of the Crucible Steel Company of America, Syracuse, N. Y., as technical speaker. Mr. Stagg chose "Tools and Tool Steels" as his subject. It was his second appearance before the group.

H. J. Stagg

His address, illustrated with slides, concerned the proper and improper design of tools and dies. Correct materials were indicated for each design discussed.

Mr. Stagg explained the reasons for choosing these metals and pointed out the consequences resulting from specifying the wrong materials. The fundamental lecture gave the audience valuable and tangible information.

Officers elected for the coming year were: Chairman, Lorin Hayden; First Vice-Chairman, George R. Squibb; Second Vice-Chairman, Joseph Aprile; Secretary, Richard Honekamp; and Treasurer, Ralph Heidenreich.

Close Cooperation Vital To Science and Industry

Pittsburgh, Pa.—February meeting of Pittsburgh Chapter was held on the first at the Fort Pitt Hotel, 90 members and guests attending the dinner and technical session.

Election of Chapter officers for the ensuing year resulted as follows: Chairman, William H. Schott; First Vice-Chairman, P. H. Magnus; Second Vice-Chairman, W. S. Risser; Treasurer, G. C. Wood; and Secretary, Carl Johnson.

Guest speaker of the evening was Dr. S. A. Braley, Senior Fellow, Mellon Institute, whose subject was "Application of Science to Industry."

Dr. Braley's many years of experience in research and industry gives him an impartial perspective on American production records. Industry, always impatient to get into mass production on a new idea, has generally been ahead of science in his opinion. On the other hand, he pointed out, this very impatience has often been the cause of failures.

Quality Control Reduces Waste

Cincinnati, Ohio — John Harrington, Chief Engineer, DoALL Company, Gage Division, Minneapolis, Minn., was the technical speaker at a meeting of Cincinnati Chapter held January 8 in the Engineers Headquarters Building. Mr. Harrington's subject was "Quality Control."

Stressing the importance of periodic inspection of parts before they reach the inspection department, he warned that a nine per cent work spoilage places the average industry on the brink of bankruptcy.

Through accurate gaging at the machine and in the inspection department, he explained, spoilage can be held to a healthy figure.

An interesting display of gaging equipment supplemented Mr. Harrington's address.

Esser Unfolds Principles Of Hydraulic Circuits

Windsor, Ont.—At the January meeting of Windsor Chapter, Rupert Esser of the Gerotor May Corporation, Logansport, Indiana, gave a blackboard talk on "Hydraulic Circuits and Equipment" as applied to machine tools.

His method of handling a broad and somewhat difficult subject without the aid of films or slides was excellent, commanding the attention of the audience.

His account of the development of hydraulic circuits from first principles in relation to the various functions to be performed proved particularly interesting and very easy to follow.

The speaker treated the various elements of hydraulic circuits quite minutely, devoting a considerable portion of the talk to various types of valves, including the application of foot, hand, cam and solenoid-operated, remote control, sequence and pilot-operated valves.

One hundred and six members attended the dinner meeting in the Prince Edward Hotel.

Dreher Lectures On "Bronze"

Los Angeles, Calif.—January meeting of Los Angeles Chapter was held on the 10th at Scully's Cafe, where dinner was served to 104 members and guests.

First speaker of the evening was L. M. K. Boelter, Dean of Engineering, University of California at Los Angeles. Dean Boelter described the engineering courses to be given at the University, stressing the need for a broad engineering knowledge before training in specialized branches.

The technical address was given by George K. Dreher, Vice-President, Ampco Metals, Inc., of Milwaukee. His subject, "A Practical Approach to Bronze," was illustrated with slides, followed by sound and color motion pictures narrating the development of bronze from the time of the Stone-Age man.

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On January 25 the Chapter held a stag party at the Valley Park Country Club, Van Nuys, where dinner was served to 437 members and guests by the famous Stearns Catering Company.

The record turnout nearly exhausted the caterer's supplies, but everyone went home well fed and happy after an excellent entertainment staged by Kenneth Harlan's theatrical agency.

Local Committee to Study Surplus Goods Situation

Phoenix, Ariz.—Members of Phoenix Chapter held their January meeting on the 31st at the Duppa Villa Homes Auditorium.

A representative of the Quality Tool Company described the "Micro-Arm," a tool expected to be useful to all tool makers.

Public Relations Chairman, Neil McLeod, spoke on the difficulties encountered by new companies in attempting to secure surplus government machinery and equipment with which to begin operations. An open discussion of the problem resulted in a decision to appoint a committee to study the situation.

During the evening, T. P. Papandrew and Beryle Williams were elected to the Chapter Nominating Committee.

While severe production cutbacks in Phoenix industry after V-J Day caused many members to move to other localities, the Chapter has weathered the crisis, and meeting attendance is on the increase.

The Facilities Building of the Duppa Villa Homes Project, recently made available to the Chapter by the Phoenix Housing Authority, has proved a popular meeting place. Here, after meeting adjournment, members may mingle informally while constructing and consuming "Dagwood Sandwiches" in the Facilities kitchen.

Washbond to Head Illinois Group

Springfield, Ill.—Harry Washbond was elected Chairman of Springfield Chapter at their February dinner meeting held on the 5th in the Hotel Abraham Lincoln. Other officers named were: Henry Becker, First Vice-Chairman; Francis James, Second Vice-Chairman; Paul Knecht, Treasurer; and Theodore Schlitt, Secretary.

John V. Javorsky, retiring Chairman, was elected Delegate to the National Meeting in April, with Mr. Becker as Alternate.

Preceding the election of officers, Emil F. Norelius, Consulting Engineer for Allis-Chalmers Mfg. Co., Milwaukee, Wis., described his visit to Germany last fall as a representative of the company. He told of viewing scores of bombed-out German factories and cities.

The meeting closed with a showing of sound films.

Prominent at the February meeting of Pittsburgh Chapter were, left to right: Retiring Chairman C. E. J. Brickner, Second Vice-President W. B. Peirce, Chairman-Elect William H. Schott, and Dr. S. A. Braley of the Mellon Institute, technical speaker of the evening.

Many Fields Supply Contributors to "Tool Engineers' Handbook"

THE WIDE RANGE OF MATERIAL being covered in the prospective "Tool Engineers' Handbook" demands the accumulated knowledge and experience of experts from innumerable branches of industry.

Among those who are now preparing manuscripts, for the manual which the Society expects to have available by the end of this year, are:

Charles M. Parker, Secretary, Committee on Manufacturing Problems, American Iron and Steel Institute, New York City, a native of Boston, Mass. There he graduated from the English High School, and from Wentworth Institute where he specialized in foundry chemistry and metallography.

C. M. Parker

From 1921 to 1930 he was employed at the Boston office of the Bethlehem Steel Company where he did foundrywork and metallurgical order detail. He severed this connection to enter Massachusetts Institute of Technology, specializing in physical metallurgy and materials testing for which he was granted a B.S. in 1934.

Since that time he has been associated with the American Iron and Steel Institute, working on standardization, simplification and metallurgical development in the fields of conservation and mechanical testing.

Has Many Affiliations

Mr. Parker is a member of the American Society for Metals, the American Institute of Mining and Metallurgical Engineers, the Army Ordnance Association, Mechanical Standards Committee, the Standards Council and the Conference of Staff Executives of the American Standards Association, the Alloys of Iron Research Committee of the Engineering Foundation, the Carbon-Manganese Research Project of the American Welding Society, and Committee A3 on Pig Iron of the American Society for Testing Materials.

He is the author of many papers and articles on National Emergency Steels, conservation of critical materials and the testing of steel, several of which have been published abroad and translated into Russian; and the books, "Steel in Action," and "The Metallurgy of Quality Steels."

Contributes to Magazines

His published technical articles include: "The National Emergency Steel Compositions," *ASTM Bulletin;* "The Conservation of Steelmaking Raw Materials," *Welding Journal*; "The Evaluation of Steel by the Standard End-Quench Hardenability Test," and "The Subzero Treatment of Steel," *American Machinist*; "Some Wartime Developments in Steel Technology," *Valve World;* and "The Mechanical Properties of the AISI-SAE Steels," *Materials and Methods.*

Among lectures he has delivered before technical organizations are: "Some Effects of Priorities on Steel Technology," Portland Cement Association; "Steel Standardization Activities," American Iron and Steel Institute; "The National Emergency Steels," "The Relationship of the Physical Properties of Steel to Its Chemical Composition and Internal Structure," and "Hardenability Bands," American Society for Metals; "Alloy Steel in the Postwar World," American Marketing Association; and "Steel Looks to the Future," Baltimore Society of Engineers.

* * *

A veteran with SKF Industries, Inc., since 1919 when he joined the parent company in Gottenburg, Sweden, **Gunnar Palmgren** is now Chief Engineer for the American plant at Philadelphia.

Gunnar Palmgren

During the first three years of his association with the Swedish firm, he was in charge of the mechanical division of the laboratory, supervising all kinds of bearing tests and other investigations, such as measurement of the dynamic radial and axial shock loads on railroad boxes in service.

Develops Roller Bearings

Subsequently, he was assigned to the task of developing and promoting the use of roller bearings in steel mill equipment, particularly the roll necks in rolling mills, hot and cold. This work necessitated extensive measurements of loads for the purpose of obtaining a basis from which to calculate the loads and their variations, in order to intelligently develop successful designs of bearing applications.

The project also involved new designs of the complete stands in bar and rod mills, cold rolling mills of the two-high, four-high and cluster type, and new Universal Couplings to make the mills better adaptable to roller bearings.

This led to the development of the unique cold rolling mill in which three rolls are used, and the load is carried by two large hardened steel rings in the bores of which the necks of the load-carrying rolls rotate. This type of mill is now manufactured on license by the Treadwell Engineering Company, Easton, Pennsylvania.

In 1934 Mr. Palmgren came to this country to assume his present post where his field of activity broadened considerably in that the bearing problems of all industries had to be dealt with.

These range from roller bearings up to 48" O.D. and over, for the largest steel and aluminum rolling mills, down to the smallest and most delicate aircraft instrument bearings. In between are bearings for all industries and every conceivable application.

Improves Spindles

One result of his attention to the problems of the machine tool industry has been improved spindles in which double-row, cylindrical roller bearings and thrust ball bearings are used for obtaining maximum rigidity radially and axially, combined with lowest friction and lowest heat generation.

Another improvement he fostered was the introduction of the so-called oil mist lubrication, increasing the life of ball bearings in high speed grinding spindles.

Mr. Palmgren is a member of the Society of Automotive Engineers, serving on the Ball and Roller Bearing Committee, and the ABEC, RBEC, and TBEC (Annular, Roller, and Thrust Bearing Engineers Committees). During 1944-45 he chairmanned the ABEC group.

At the International Standards Association Conference in Finland, 1939, he was one of two American delegates.

Technical societies here and abroad have heard his addresses, such as "Introduction of Roller Bearings in Rolling Mills," presented before Jernkontoret in Stockholm; "On the Application of Roller Bearings in Rolling Mills," delivered before a technical society in Luxembourg; and "Roll Neck Bearings," a lecture given to a conference of the A.E. & S.E.E. in this country.

Writes Technical Articles

Various magazines have published his technical articles which include: "Contribution to Discussion of the Energy Balance in the Swedish Steel Industry," and "Introduction of Roller Bearings in Rolling Mills," *Jernkontoret Annal*; "Results Obtained from Roller Bearings in Rolling Mills," *The Iron Age*; "On Modern Cold Rolling Mills with Roller Bearings," *Stahl & Eisen*; "On the Application of Roller Bearings in Rolling Mills," *Revue Technique Luxembourgeoise*; and "Roll Neck Bearings," *Iron and Steel Engineer.*

* * *

Raymond A. Cole, Vice-President of Pope Machinery Corporation, Haverhill, Massachusetts, has been associated with the machine tool business for over 30 years —most of which he has devoted to the field of precision grinding.

R. A. Cole

He received his early education at Chicopee, Massachusetts, and his engineering training at Worcester Polytechnic Institute. During the next six years, his designing experience ranged from candy making machinery to tools for machine guns. It included positions with such varied firms as Strathmore Paper Company, New England Westinghouse Company, and National Equipment Company of Springfield; Fisk Rubber Company, Chicopee Falls; Robert T. Pollock Company, Boston, Massachusetts; and Colt's Patent Fire Arms Company of Hartford, Connecticut, his native city.

Did Research

In 1919 Mr. Cole joined Norton Company, Worcester, Massachusetts, as Experimental Engineer. When he left this concern in 1945 to accept his present position with Pope Machinery, he was in charge of research and development in the Grinding Machine Division.

Various Chapters of ASTE and ASME have enjoyed Mr. Cole's technical talks. At the ASTE 1944 Annual Meeting, he participated in a symposium on Electronics, reading a paper on the application of electronic control to grinding machines. From time to time he has contributed articles to technical magazines.

A Past Chairman of Worcester Chapter, ASTE, Mr. Cole is also affiliated with ASM and the Society for Experimental Stress Analysis.

TOOLS OF TODAY

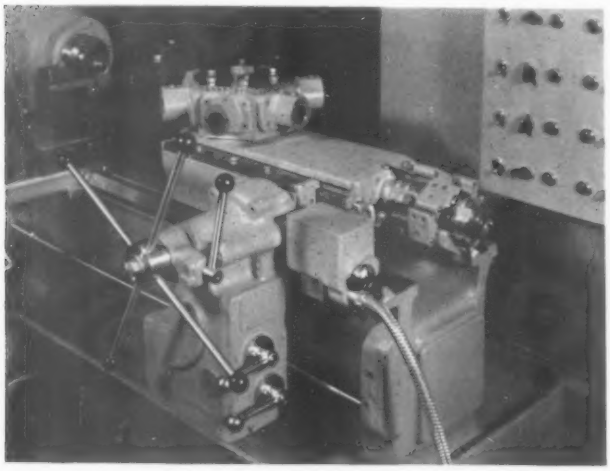
New Monarch Screw Machine

CLAIMED TO BE one of the highest production units of its kind, a new hand screw machine, designed to handle small turning work in quantities of from 25 to 500 or more pieces, is announced by *Monarch Machine Tool Company*, Sidney, Ohio. Named the SPEED-MATIC, the new machine has power feed ram type turret, hand operated cut-off slide and pre-selected, changeable spindle speeds ranging 50 to 5000 rpm.

The bed, mounted on a sturdy base which insures long life and proper alignment under severe conditions, is of special cast iron, flame hardened and ground for sustained accuracy. The spindle, of high carbon steel, electric furnace hardened and ground, is provided with a 3" American Cam Lock mounting and runs in precision ball bearings. The bore will accommodate bar stock up to $^{7}/_{8}$" diameter.

The gear box, of simple design, permits two feeds to the feed rod, with high or low feed obtainable by shifting one lever. To simplify design and operation, the screw cutting parts (not necessary with this machine) have been omitted. The power feed turret has six additional feeds to the turret slide; this, multiplied by the high and low feed of the main gear box, gives a complete range of 12 feeds (from .0005" to .016" per revolution), sufficient to cover practically any type of work. The turret slide is manually operated by capstan handwheel and is power fed through the rod which connects to the main gear box.

A precision, high production tool, the machine has all of the inherent qualities that are characteristic of the Monarch line of machine tools.



Variable-Speed Speed Lathe

SINGLE FOOT-PEDAL control of full work cycle is one of the unusual features of this air-operated, heavy-duty, variable-speed SPEED LATHE made by the Schauer Machine Company, 2600 Reading Road, Cincinnati 2, Ohio.

This machine will handle up to $1^{3}/_{8}$" maximum capacity collet. Step chucks, expanding mandrels, or special work-holding fixtures can also be used.

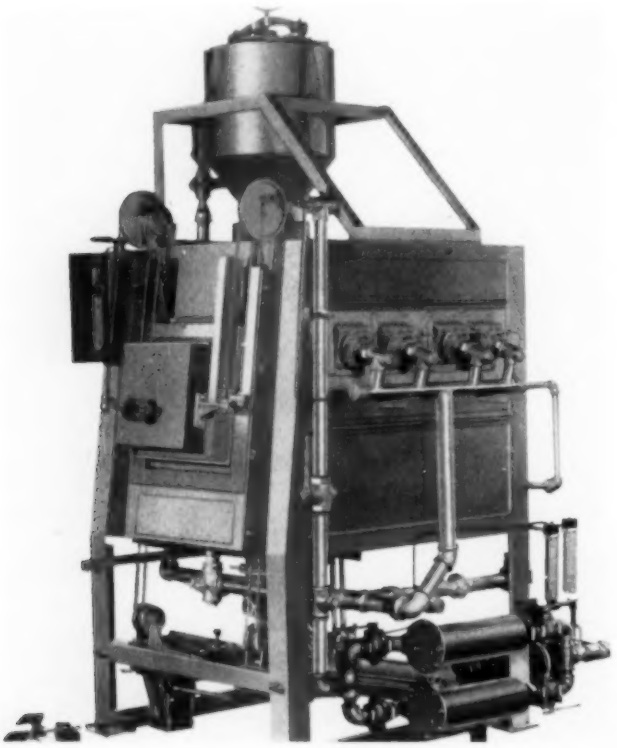
Motor operates continuously. Depressing the foot pedal closes collet, releases brake, and connects motor to work spindle through a Twin-Disc clutch assembly. Air line is provided with control valve which permits time-lag before the collet releases the work.

Variations in spindle speeds are obtained through the use of a Reeves drive.

New Dual Purpose Furnace

FOR INCREASED flexibility in handling different batch type heat treating operations, a new atmosphere muffle furnace is now offered by *Surface Combustion Corp.*, Toledo. Due to a new feature of design, the furnace can produce the proper atmosphere for gas carburizing, yet is also applicable for general heat treating.

After producing the basic atmosphere, the furnace utilizes a new gas enriching and recirculating system for gas carburizing. (Sectional view.) Instead of circulating all the gas in the muffle through the enriching system, thus tending to cool the entire amount, only about 10 per cent is removed from the muffle at any time. This gas is continuously withdrawn near the door, and is first filtered to remove any free carbon which may have dissociated from the CO in the atmosphere. After filtering the atmosphere gas, the enriching gas (raw material gas or propane) is added through a metering orifice. The gas then passes to the recirculating pump, which is of the positive displacement (vane) type. The gas under pressure is discharged at high velocity into a venturi a large volume of muffle gases. These are mixed in the venturi and recirculate throughout the muffle.



New Carbide Tipped Reamers

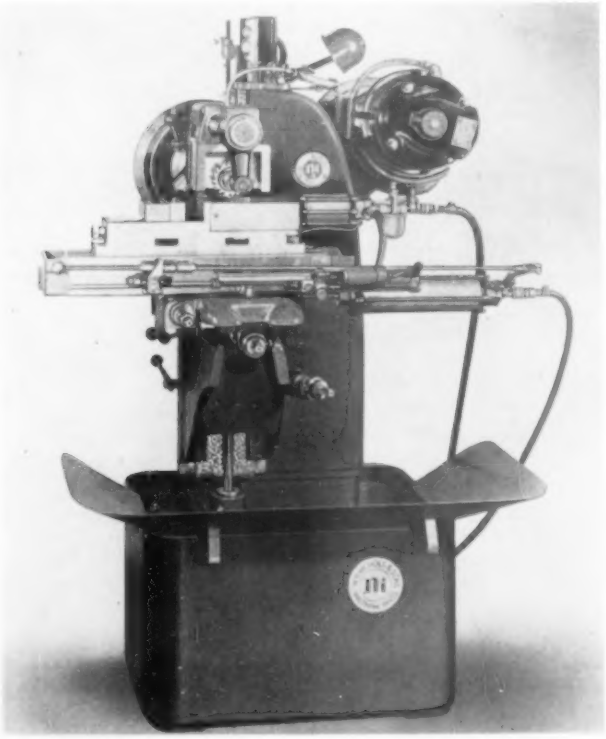
NEW CARBIDE-TIPPED SOLID REAMERS are now available, at prices but slightly higher than those of the conventional tool, from *The Super Tool Co.*, 21650 Hoover Rd., Detroit 13. The makers claim that the new reamer gives better finish and longer life, with decrease in scoring or galling and no wear on the flutes back of the cutting section.

New Roller Lapping Machine

PRODUCTION IS INCREASED and quality of workmanship enhanced with a new ROLLER LAPPING MACHINE, recently developed by *Spitfire Tools, Inc.*, 2930 N. Pulaski Road, Chicago 41, for lapping and polishing round plugs, pins or rods. The work is loaded and unloaded without stopping the machine and, since the rollers dissipate the generated heat to a great extent, a "cooling period" is ordinarily not necessary.

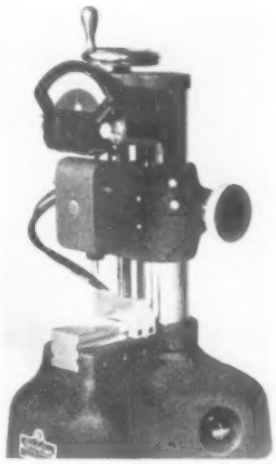
New Feed Attachment by Nichols

W. H. Nichols & Sons, Waltham, Mass., has announced a new power table feed attachment for their miller. This attachment offers rapid approach, maximum cutting feed, fast table return and shut-off. Thus, the operator needs only load and unload the work. Basically, the attachment is a Bellows air feed unit used in conjunction with a Hydro-Check, with both the air and hydraulic units infinitely variable to suit the work being produced. The maximum cutting stroke, with this attachment is 9 inches, and it can be operated from any shop air system carrying 75 to 175 pounds of air.

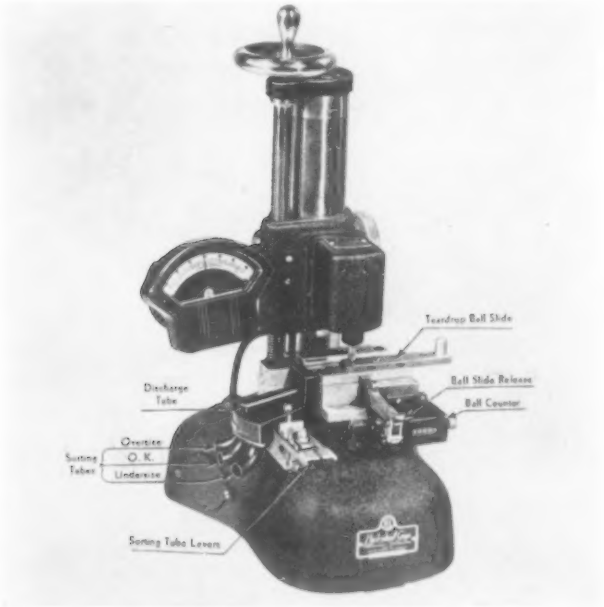


New Electric Comparator

A NEW ELECTROLIMIT COMPARATOR, designed for fast and accurate external inspection, is announced by *Pratt & Whitney* Div'n, of Niles-Bement-Pond Company, West Hartford, Conn. Ingenious yet simple, an electric contact unit combines with the Electrolimit head to instantly indicate "Go" and "No go." Small neon lights are positioned at the sides of the meter—minus at the left, plus at the right. The minus light is normally on and remains so when the part is undersize; if oversize, it goes out, when the plus light flashes. Both lights are off when the part is within the correct limits. If however, the operator wishes to check the actual size reading, it is only necessary to slow the high speed gaging operation, when direct reading can be taken on the indicating meter.



Provided with a ball sorting attachment, as shown in larger photo, the Electrolimit Comparator permits fast and accurate checking of precision balls. With the addition of a cup type hopper and tube, the rate of inspection is greatly accelerated. Incidentally, the indicating meter can be graduated to permit ball inspection to "tenths," "half tenths" or hundredths," of .001". Literature, describing all details of these precision comparators, is available from the makers.



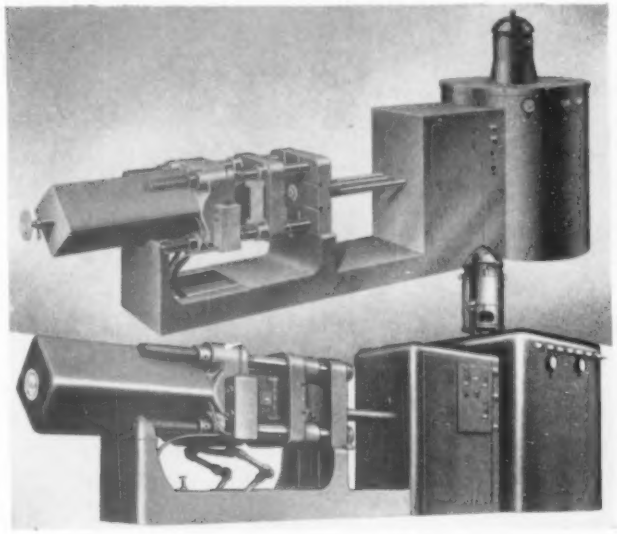
Packaged Arteries by Fauver

J. N. Fauver Co., 49 W. Hancock, Detroit 1, now offers hydraulic fittings—termed "PACKAGED ARTERIES"—packed and delivered in one carton. These kits contain metal tube shapes, hose assemblies and prefabricated accessories used for hydraulic systems, both high and low pressure.

Prefabricated metal tube shapes are supplied in sizes ¼" to 1½", in any length or combination of bends, and with ends flared or not as required. Fauver hose assemblies, 5/16" to 1½" I.D., are supplied with either permanent or reusable couplings for working pressures 300 to 6000 p.s.i. Since assembly consists merely of tightening nuts, all cutting and fitting on the job is eliminated.

New Die Casting Machines

THE FOURTH basic model of a new line of DIE CASTING MACHINES, known as the HDW series, has been announced by the *H. L. Harvill Mfg. Co.*, Los Angeles, Cal. This machine is a high capacity, cold chamber type with provision for the addition of a hot chamber furnace and an injection attachment. Hydraulic pressures range from 200 to 1,000 P.S.I., with plain water used as the hydraulic fluid. This machine is particularly adapted to casting copper base alloys. A conversion unit replaces the cold chamber injection mechanism and converts the cold chamber to a hot chamber automatic machine for casting zinc, tin and lead alloys. Descriptive literature is available from the maker.

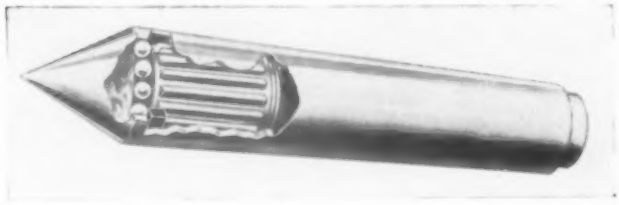


Tracer for Surface Roughness

A NEW TYPE **TRACER**—AW—has recently been introduced by *Physicists Research Co.*, Ann Arbor, Michigan. This device is used in conjunction with the Profilometer and increases the range of surfaces on which roughness measurements are taken. The tracer will measure the roughness of surfaces on all outside diameters and on all inside diameters down to ¼ inch, also on internal and external tapered surfaces and gear teeth.

New Live Center

A NEW **LIVE CENTER**, made of hardened and ground alloy tool steel and claimed to have a life of approximately 3,000 hours, is manufactured by Samuel S. Gelber Co., 32 So. Jefferson, Chicago 6. The center is equipped with precision thrust and radial roller bearings.



Ram Pacer By Southwark

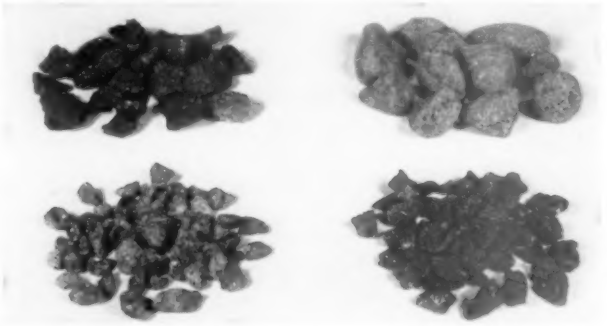
THE *Baldwin Locomotive Works* (Southwark Div'n), Philadelphia 42, Pa., has developed a **RAM PACER** which, attached to a standard hydraulic testing machine, controls the crosshead movement at eight pre-set speeds—.01, .02, .05, 0.1, 0.2, 04., 0.5, and 1.0 inches per minute. Actually, the Ram Pacer is a combination tool, since it also can be used as a deflectometer. If the motor is not turned on, it will indicate the deflection of a specimen under test.

New Precision Die Filer

The All American Tool & Mfg. Co., 1014 W. Fullerton Ave., Chicago, have introduced the **ALL AMERICAN PRECISION DIE FILING MACHINE** which insures complete accuracy in filing, honing and sawing. This is made possible by a patented universal joint file clamp which assures a 100% vertical file position regardless of warped or twisted file shanks. A file setting square is supplied for aligning the file or other tool before the universal joint is tightened. The unit is completely described in Bulletin 115, available on request.

Alundum Abrasive Available

ALUNDUM ABRASIVE, now marketed by *Norton Company*, Worcester, in a special form for use for wet tumbling. A hard, heavy, tough and fast cutting aluminum oxide product that is excellent for cleaning, deburring and finishing, and for the development of radii on a wide variety of metal parts, it is available in four size groups, namely: ¼-½", ½-¾", ¾-1", and 1-1½" diameters, either untumbled or tumbled (sharp corners rounded).



Normally used with water and a cleaner, Alundum Abrasive for tumbling has proved to be superior to other methods of deburring and finishing. It has eliminated the variable results obtained by the usual manual bench operations. Radii on gears, for instance, have been held to exact blueprint specifications on lot after lot while costs were considerably reduced. Of particular interest, it is claimed that precision parts are being consistently held to a one microinch finish by tumbling with Alundum Abrasive. Finishes with a higher micro reading than one, can be maintained or improved.

The illustration shows the smallest and largest sizes in tumbled form, and the other two sizes untumbled. The extreme hardness of Alundum Abrasive provides continuous fast cutting action, without glazing over, as is often the case with other tumbling materials.

Accurate Gear Broaching

ACCURATE BROACHING of internal gears, from the drilled holes, is now being done on standard 30-ton hydraulic **PULL-DOWN BROACHING MACHINES**, product of *Colonial Broach Company*, Detroit 12. In the illustration, seven of these machines are shown broaching internal gears to accuracy within .0002". Simple fixtures are employed, and each machine can broach several sizes by the mere changing of broaches.

North East West South in Industry

An Occupational-Independence plan, which seeks to encourage the creation of additional small enterprises in the metal, wood and plastic working field, and their expansion is proposed by **Leighton Wilkie**, Ch'man of the **DoALL CO.**, Des Plaines, Ill. Mr. Wilkie, who with many leading industrialists is gravely considering the reemployment problem, holds that the only hope for the absorption of all employables in the United States lies in the success of the small business enterprise.

Dr. Wendell F. Hess, professor of Metallurgical Engineering, Rensselaer Institute, has been elected President of the **AMERICAN WELDING SOCIETY** for '46. Prominent in engineering and educational circles he was awarded the Lincoln Gold Medal by the Resistance Welder Mfgr's Ass'n, and the Medal of the A.I.S.I.

R. M. Underwood has joined the **PIONEER ENGINEERING & MANUFACTURING COMPANY** as Director of purchasing, according to A. M. Sargent, company president. He will also act for the Pioneer Pump & Mfg. Co. Serving with Aviation Corp'n during the war, Mr. Underwood was previously connected with Packard and Hudson Motor—ten years with the latter concern.

Establishment of a separate carbide alloy sales division, with **P. E. Floyd** as manager of sales, is announced by Russell M. Allen, Vice-President of the **ALLEGHENY LUDLUM STEEL CORP'N**, Brackenridge, Pa. Mr. Floyd will direct the company's expanded carbide alloy sales activity from the division's headquarters at Ferndale, Michigan.

Donald L. Schwartz has joined **CARBOLOY CO., INC.**, as Research Metallurgist. A graduate of University of Michigan, with a Master's Degree in Metallurgical Engineering Mr. Schwartz was previously superintendent of the metallurgical laboratory of Cleveland Graphite Bronze Co. Coincidentally, **A. J. Rod** has been appointed as Sales Engineer by Carboloy. He will be in charge of the Houston branch as the district manager.

John O'Hara Harte has been appointed Director of Public Relations and Plans at the **McLAIN ORGANIZATION**, Philadelphia. With the appointment of Mr. Harte, the 38-year-old McLain organization also announced the formation of a public relations department to service its clients, as well as additional outside business.

Roger F. Waindle, formerly manager of industrial sales for the Sapphire Products Div'n, *Elgin National Watch Co.*, has been appointed general manager. A graduate of Illinois Institute of Technology, Waindle is a member of the American Society of Tool Engineers, ASM Army Ordnance Ass'n, American Soc'y of Military Eng'rs, and the Engineering Society of Detroit. During the war, he served as chief of tank-automotive production for the Chicago Ordnance District, Army Service Forces.

GRINDERS & FIXTURES, of which **George G. Auer** is president, has acquired from Cleveland Tool Engineering all manufacturing rights to the latter's two principal products—the Circular Relief Grinder and Universal Indexing Head. C. E. Walling, the former owner, has joined G.&F. and will be in charge of experimental and development work.

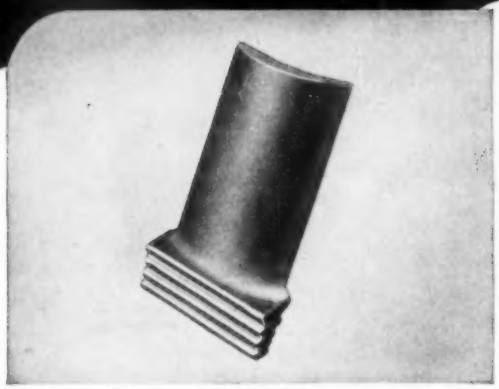
Ernest G. Merlin has been appointed Secretary and Sales Representative of **CARBIDE DIE & MOLD CO.**, 415 Neptune St., Pittsburgh, Pa. Mr. Merlin learned production at Mesta Machine Co. In 1930 he joined Firth-Sterling's carbide tool divisions, where duties kept him in touch with tungsten carbide production and sales.

Practical applications of adjustable speed drive, by prominent machine tool engineers, will be a feature of the 1946 Westinghouse Machine Tool Electrification Forum to be held at William Penn Hotel, Pittsburgh, April 9 and 10. This, the 10th Annual Forum sponsored by **WESTINGHOUSE ELECTRIC CORPORATION**, is planned to give machine tool engineers and executives an opportunity to discuss electrical problems relative to the design and function of machine tools. Prominent among speakers will be **R. L. Gaylord**, President of Ingersoll Milling Machine Co., and **W. E. Knox**, Vice-President of Westinghouse International Company.

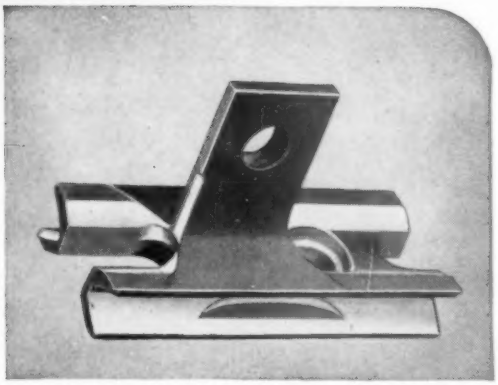
As announced by Charles W. Deeds, **NILES - BEMENT - POND** President, **Richard W. Banfield** has been appointed treasurer of the company. He succeeds **Everett L. Morgan**, who retires after about a half century of continuous service. Mr. Morgan was presented with a gold watch by Clayton R. Burt, Ch'man of the Niles Board, who also presented watches to four Pratt & Whitney employees who had completed 50 years of service.

Staples Tool and Engineering Co., Cincinnati, Ohio, makers of Carboloy-tipped expansion reamers, has changed their name to *The Staples Tool Co.* The officers are: E. M. Staples, pres., M. D. Staples, vice-pres., and V. E. Heckerman, sec'y.

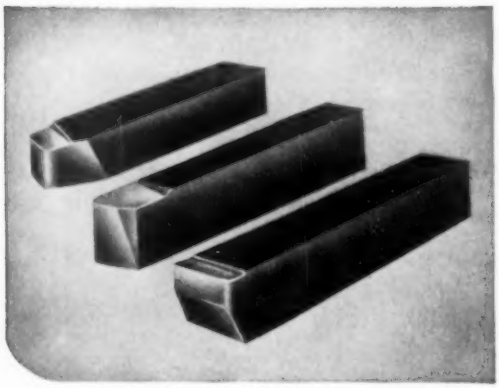
Bring Yourself Up To Date on These HAYNES *Developments in Area 1521 at the A.S.T.E. Exhibit*



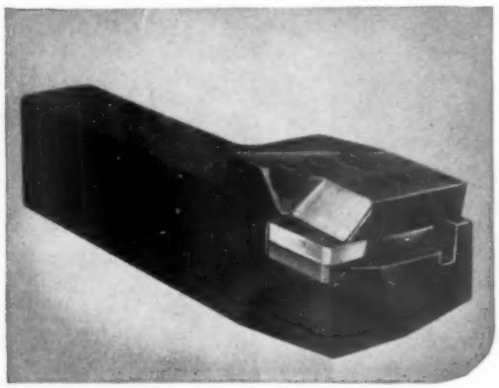
High-temperature alloys that make possible gas turbines.



HAYNES Precision Casting for mass production of quality alloy parts.



Improved alloys in HAYNES STELLITE tools and machine parts.



Tool-holder designs that will let you use small cutting tools for heavy work.

Visit us at our exhibit. There you can get important information on HAYNES metallurgical developments, much of which will not be in print for some time.

HAYNES STELLITE COMPANY

Unit of Union Carbide and Carbon Corporation

UCC

General Offices and Works, Kokomo, Indiana

Chicago—Cleveland—Detroit—Houston—Los Angeles—New York—San Francisco—Tulsa

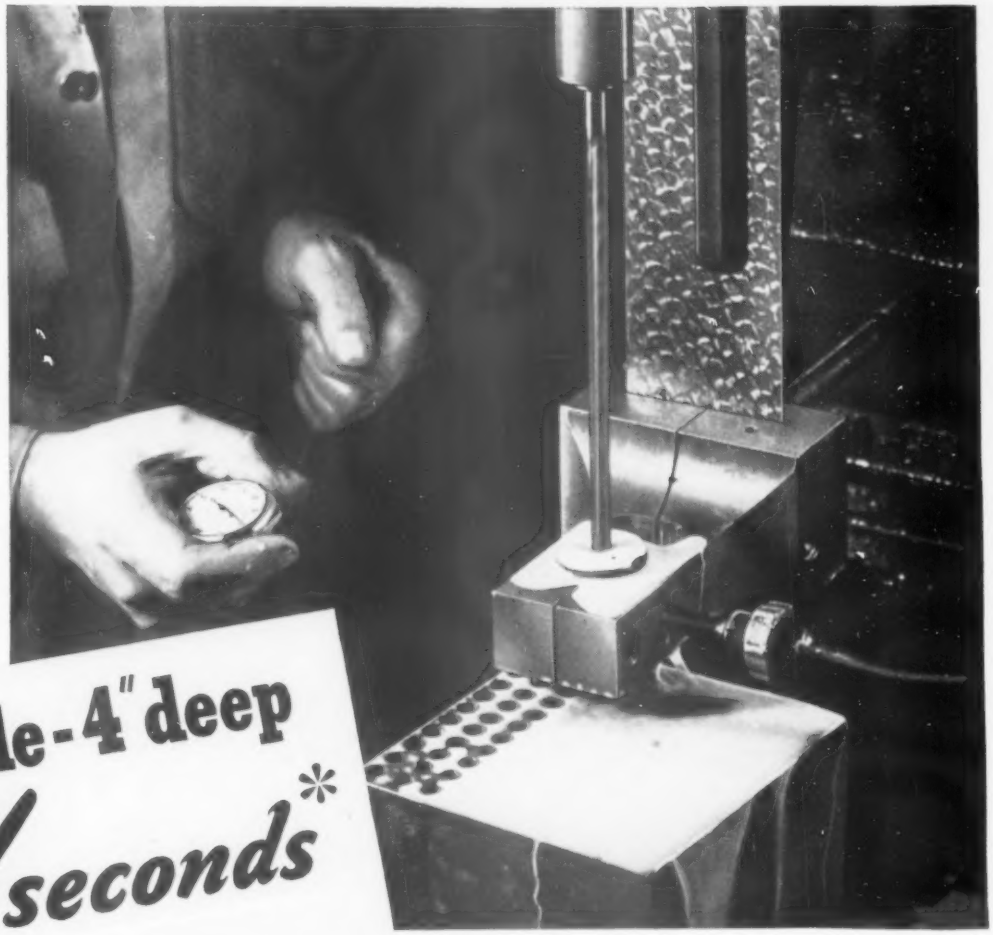
HAYNES TRADE-MARK *alloys*

The trade-marks "Haynes" and "Stellite" distinguish products of Haynes Stellite Company

P-19516

"HYPER-DRILLING" with Republic's *Jet* Drill

See it demonstrated at Booth 1214 A.S.T.E. New Era Exposition Cleveland April 8—12



3/8" hole-4" deep in 8 seconds*

Jet Drill and Jet Director — another Republic First

with the sensational new *Jet* DRILL

Faster penetration and greater "hole accuracy"—the definite advantages of drilling with the new "*Jet*" drill and accompanying "*Jet* director"—are proved by actual production drilling and laboratory tests. The "*Jet*" drill's superiority over conventional drilling equipment and methods is based upon: **(1) Use of a great volume of coolant under high pressure. (2) High spindle speeds and feeds. (3) An entirely new principle in drill design.**

**Laboratory test drilling, illustrated above*

Republic DRILL & TOOL COMPANY

CHICAGO 7, ILLINOIS

BOSTON • NEW YORK PHILADELPHIA • PITTSBURGH • CLEVELAND • DETROIT • DAYTON • BIRMINGHAM • LOS ANGELES • SAN FRANCISCO

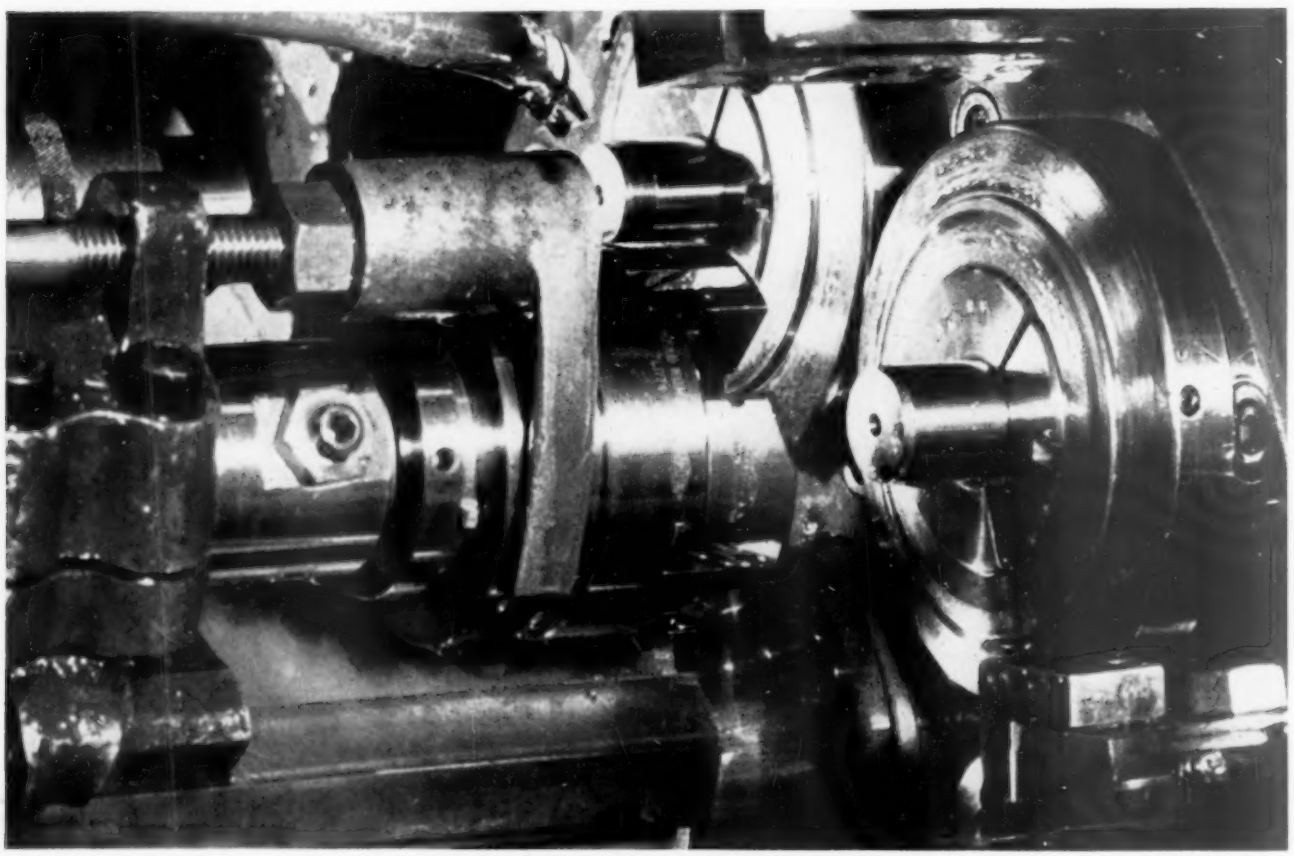
WORLD'S LARGEST EXCLUSIVE MANUFACTURER OF TWIST DRILLS

Solving Reconversion Threading Problems

The LANDEX Die Head

The Landex Hardened and Ground Die Head was used extensively during the past five years in the production of munitions and other ordnance parts.

With reconversion Landex Die Heads and other LANDIS Thread Cutting Machines and Die Heads will just as efficiently and economically produce your threaded components to the fine accuracy and high production requirements of the new peace-time schedules.



Write for Bulletin No. F-80

LANDIS MACHINE COMPANY

WAYNESBORO • PENNA • U·S·A·

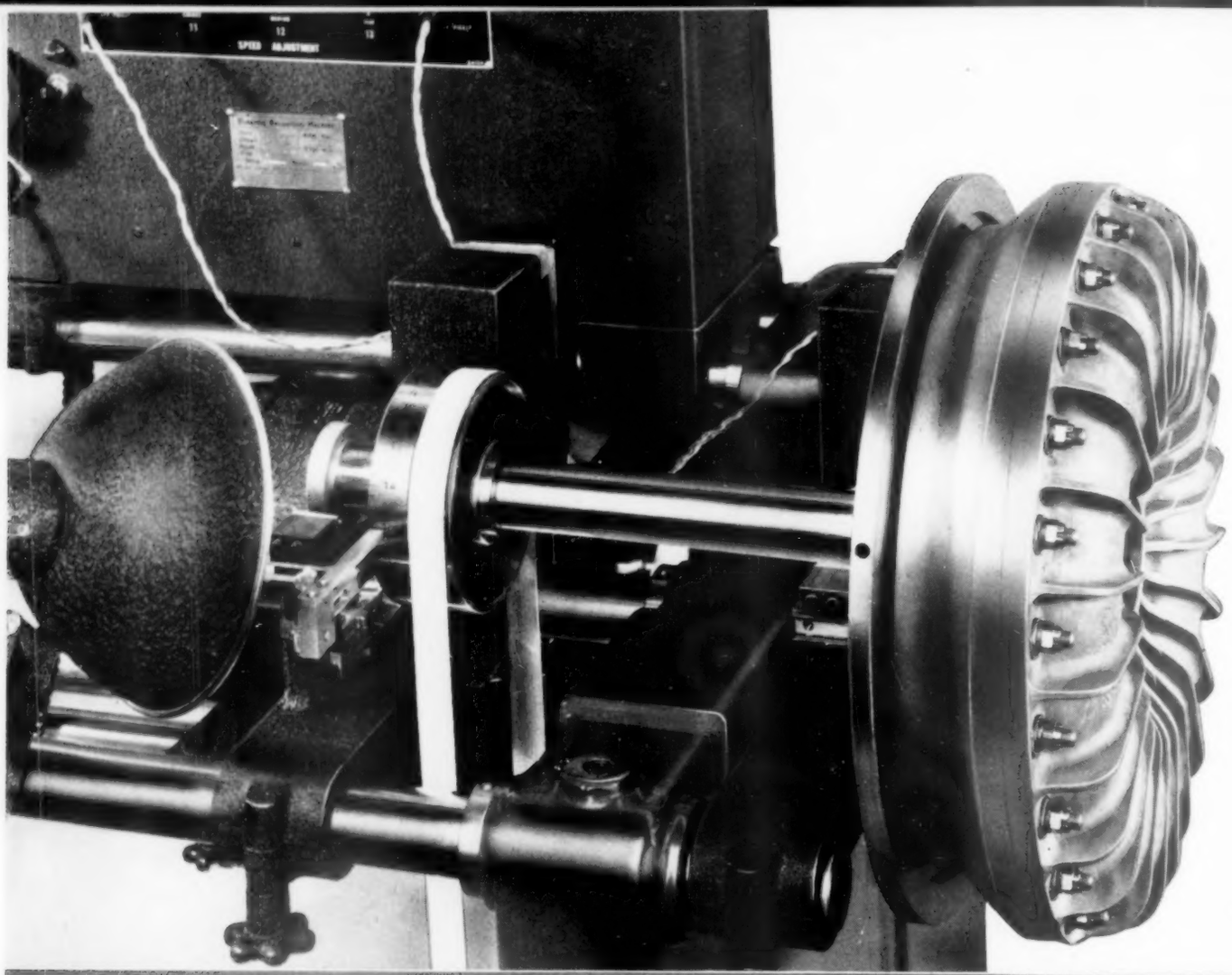
THREAD CUTTING MACHINES • DIE HEADS • COLLAPSIBLE TAPS • THREAD GRINDERS

THESE BASIC TOOLS and many others designed and produced by GAIRING for special purposes, will be on display at our booth at the Tool Show. The uses for which they are intended and their performance under a wide variety of conditions will be cheerfully explained to those of you who are interested.

GAIRING, who has faithfully served the Metal Working Industry for more than a quarter century will exhibit improved cutting tool designs, new production tools. Come in and get better acquainted, ask questions, make our booth your headquarters.

THE GAIRING TOOL COMPANY, DETROIT 32, MICHIGAN

GAIRING TOOLS



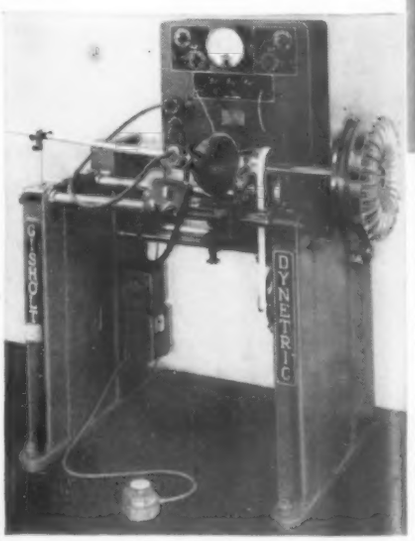
Smoothing out the Fluid Drive with GISHOLT DYNETRICS*

"Smooth as the flow of oil," describes the fluid drive. But this manufacturer goes all the way to make it the last word in smooth, vibrationless performance by balancing the assembly, too. And, of course, it's done on a Gisholt Dynetric Balancing Machine.

This is an out-of-the-ordinary application because, instead of balancing in the normal position between work supports, the cast aluminum fluid drive housing is balanced in an overhanging position. It's done this way to facilitate loading of the work piece and to make possible the easy application of unbalance corrections. This same arrangement is used for balancing axial flow fans, flywheels, and other parts of large diameter.

The basic principles used by the Gisholt Dynetrics make it possible to balance any size or shape of part to any desired accuracy. Write for literature.

**A development of Westinghouse Research Laboratories.*



This Gisholt 1-S Dynetric is arranged for balancing a fluid flywheel, or torque converter, as shown on the work support.

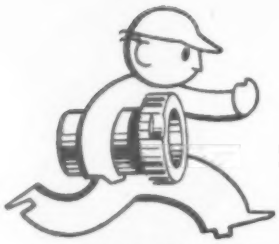
GISHOLT MACHINE COMPANY

1257 E. Washington Avenue • Madison 3, Wisconsin

Look Ahead . . . Keep Ahead . . .

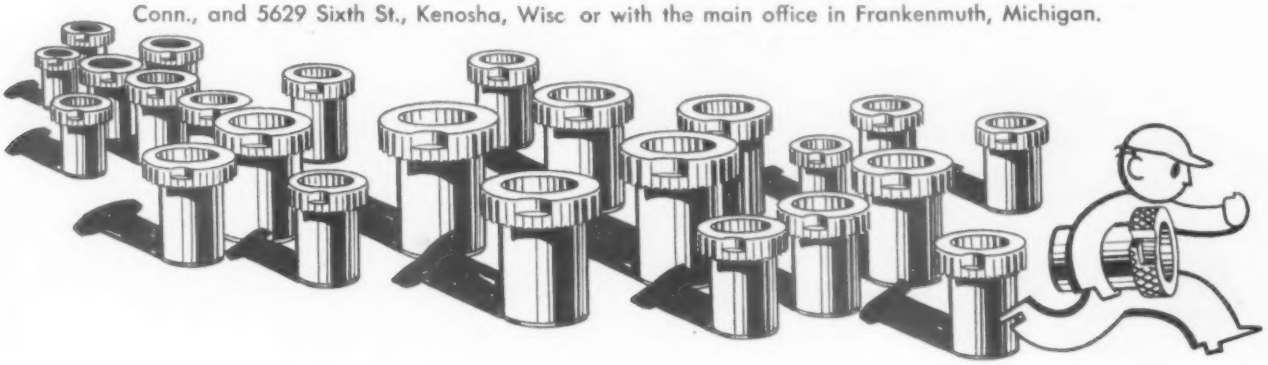
With Gisholt Improvements

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

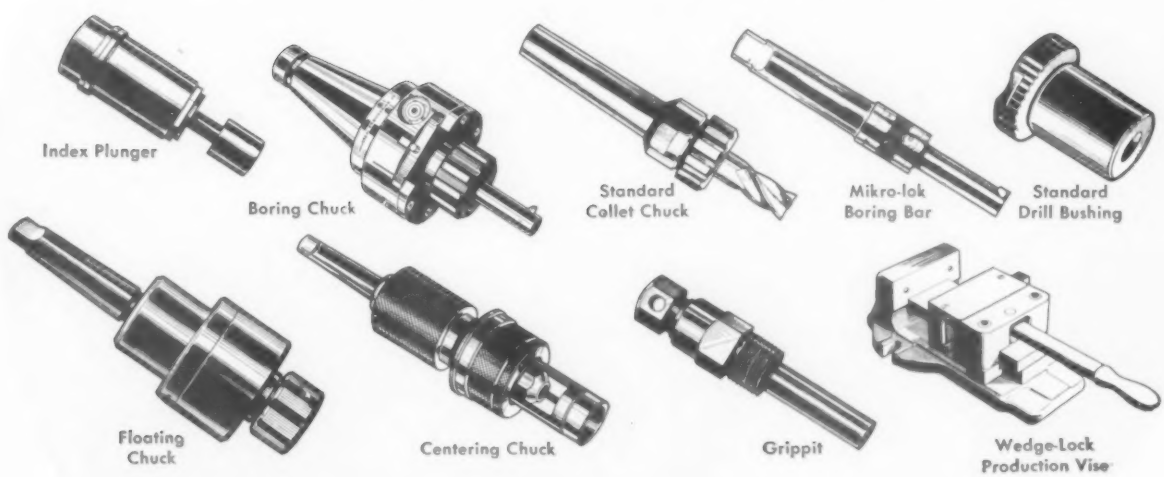


300,000 UNIVERSAL DRILL BUSHINGS NOW ON HAND FOR IMMEDIATE DELIVERY • TWO NEW UNIVERSAL WAREHOUSES ASSURE PROMPT SERVICE . . .

Universal Drill Bushings—superhoned and precisely finished straight and round to within .0001"—are now available in large quantities for immediate delivery to speed production reaming, drilling, and tapping operations in your plant. On hand in the two big, modern Universal warehouses strategically located in Kenosha, Wisc., and Ansonia, Conn., are 300,000 standard press fit and renewable bushings of unsurpassed accuracy and durability As an added service to your production requirements, these Universal warehouses offer teletype service direct to the main Universal offices in Frankenmuth, Mich., where your orders for special drill bushings, Universal chucks and boring bars and other production tools and replacement parts will receive immediate attention. For prompt delivery of drill bushings or any of the superior Universal tools illustrated, get in touch with the Universal Engineering Sales Co. warehouse nearest you: 89 Main St., Ansonia, Conn., and 5629 Sixth St., Kenosha, Wisc or with the main office in Frankenmuth, Michigan.



UNIVERSAL TOOLS THAT WILL INCREASE PRODUCTION AND EFFICIENCY IN YOUR PLANT.



UNIVERSAL ENGINEERING CO. **FRANKENMUTH, MICHIGAN**

They're Coming . . . 3 NEW MONARCHS

Watch for these names—your answer to *higher production at lower cost:*

"UNI-MATIC" . . . An automatic lathe with "production slides" (a revolutionary new principle) . . . and electronic control, universal tooling, universal positioning . . . for chucking and fixture work. *Maximum production of any machine known today.*

"MONA-MATIC" . . . A between-centers machine that makes automatic production *profitable* in any shop . . . *fully automatic, fully manual or any combination. Speeds up to 3000 rpm.*

"SPEED-MATIC" . . . A hand screw machine with automatic electronic speed change . . . 12 stations . . . *spindle speeds as high as 4000 and 5000 rpm.* We think you'll call it "*the World's Fastest Hand Screw Machine.*"

More details *here*—in April—and if you're buying metal-turning *capacity* before then, write us *first*—department 311.

THE MONARCH MACHINE TOOL CO. • SIDNEY, OHIO

ACCURACY · ECONOMY · LONG LIFE

Monarch TURNING MACHINES

This 12,500% increase *sounds fantastic!*

But True!

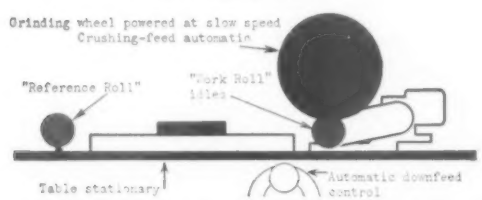
One of the major drawbacks to crush form grinding precision flat form contours has been the inability to produce on a practical production basis. This obstacle has been eliminated in two ways by the new Thompson Truforming Process.

First: Truform Grinders are engineered and built as a single unit, eliminating the failures of make-shift crushing arrangements and attachments.

Second: TWO CRUSHING ROLLS ARE USED. This is a major advancement, because it greatly extends crushing roll life and makes possible, for the first time, quantity production without constantly disturbing the set-up to re-process the crushing roll.

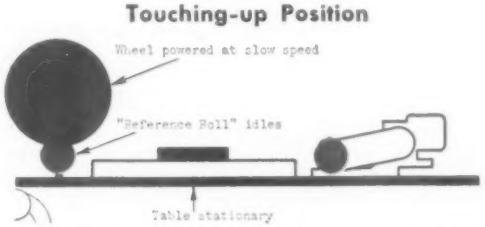
How two rolls operate in the Truforming Process is briefly illustrated and described below. The normal crushing or truing position is shown first.

Normal Crushing Position
Also Truing or Dressing



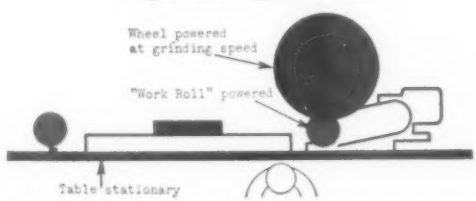
This is the position for the initial crushing of the wheel—and for subsequent truing or dressings when production grinding. On an eight pitch modified buttress thread form, 125 dressings were provided by the "work roll" before losing form.

Touching-up Position



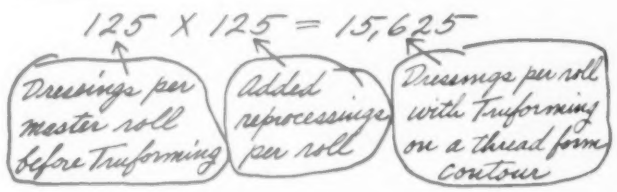
When the "work roll" loses form the table is moved to bring the grinding wheel over the "reference roll" for touching up, as shown above.

Re-processing Position



Because both rolls are table mounted, are in perfect alignment, and can be brought in the same relation to the grinding wheel, the original degree of accuracy can be quickly transferred from the "reference roll" back into the grinding wheel . . . and then ground back into the "work roll" as shown above.

The machine is then ready for production grinding again without disturbing the set-up or removing anything from the machine. In this way the "work roll" can be re-processed whenever it loses form and can be used for hundreds of additional dressings, or until it is worn out. Duplicate crushing rolls can be ground in the same way on all Thompson Truform Grinders.

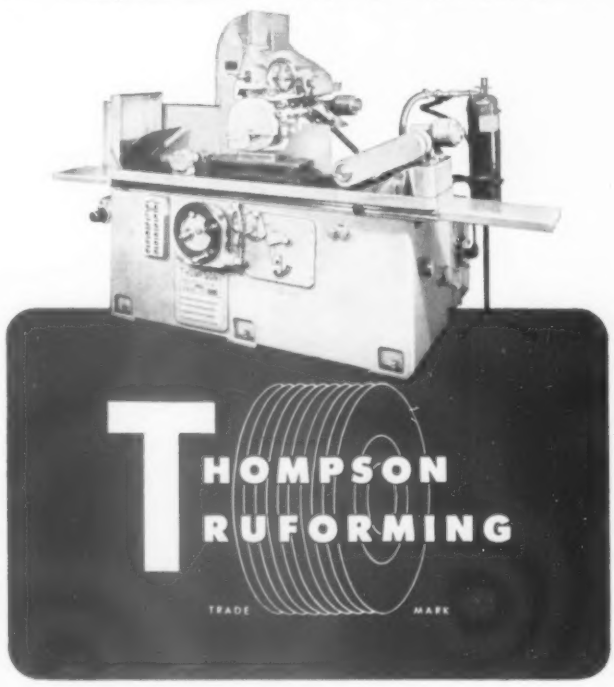

125 X 125 = 15,625
Dressings per master roll before Truforming
Added reprocessings per roll
Dressings per roll with Truforming on a thread form contour

What this means in savings is illustrated by the following example, involving a modified buttress thread form with an eight pitch form. Where two rolls are used in the Thompson Truform Process, it was possible to get *over 15,625 dressings* from the "work roll" before it was worn out. This meant an increase in continuous production (without changing or disturbing set-up) of 12,500%.

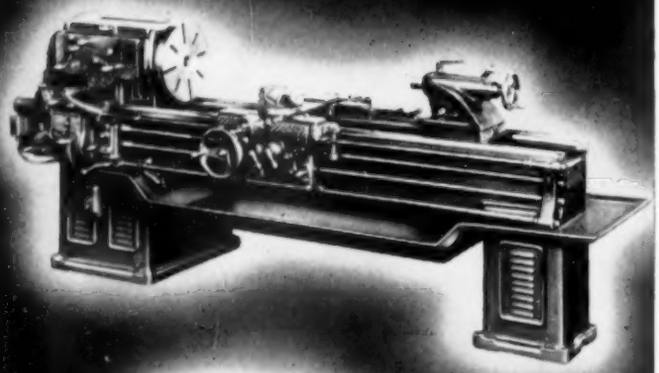
Write for the new 8-page Truform Leaflet—"Why didn't you tell me about this process before?"

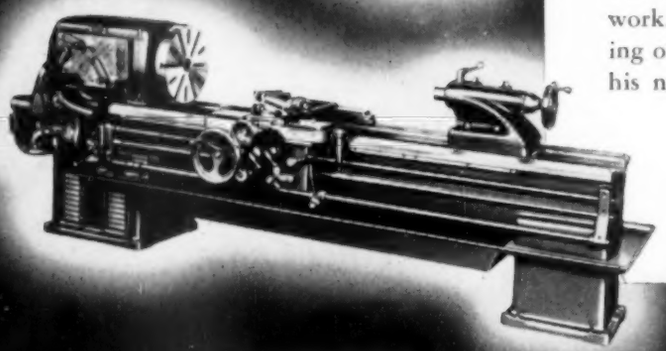
Address Dept. 16

The Thompson Grinder Company • Springfield, Ohio



Sidney Lathes





Illustrating the wide range of Sidney Lathes . . . built in capacities from 14" to 36"

All are continuous tooth Herringbone geared head machines. The Headstock is particularly quiet in operation with both spindle and intermediate shaft supported by a center bearing.

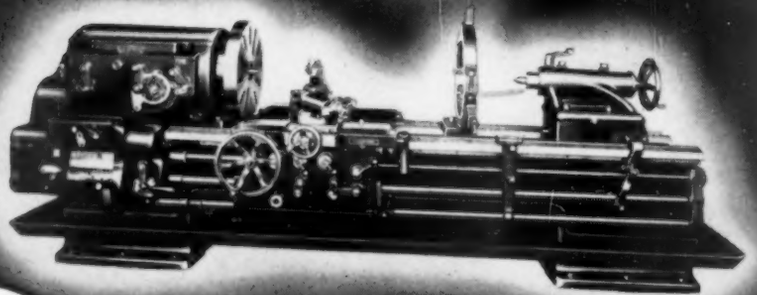
This gearing not only affords greater, smoother power on all sizes but results in highly finished accurate work free from all tooth marks.

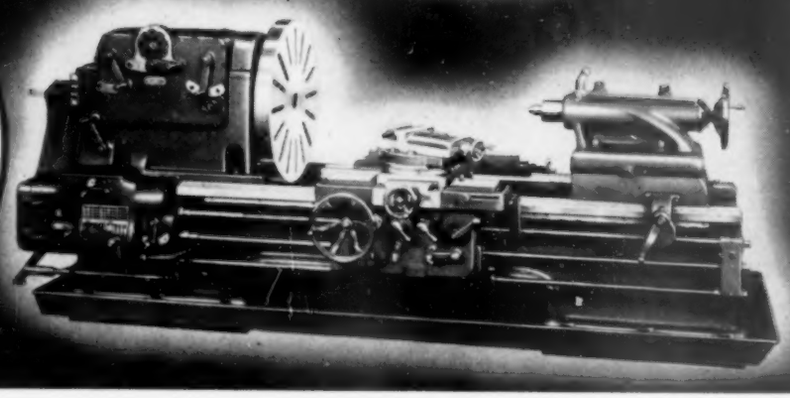
The departure from the conventional two wall bed to the Sidney four wall design with cross girts at frequent intervals assures the utmost in rigidity and maintaining alignment.

The operator is saved considerable leg work, and a great deal time by locating of controls within easy reach from his normal working position.

For power, speed and continued accuracy make your next lathe a Sidney.

Bulletins available.





Builders of Precision Machinery

THE SIDNEY MACHINE TOOL COMPANY

SIDNEY • OHIO

SIDNEY

ESTABLISHED 1904

MAKE SLOW, TIRING, MANUAL OPERATIONS *Automatic*

with Bellows Controlled-Air Power

MODEL BM-5 AIR MOTOR

You can boost production of drill presses, milling machines, grinders, etc., from 40% to 500%, by replacing manual feeding and holding operations with Bellows Controlled-Air Power Feeds, Air Vises, and Air-operated fixtures.

These inexpensive, air-powered devices are easily installed on standard or special machines — provide fast, safe, automatic operation — uniform production, hour after hour. One operator can often run two or more machines, and produce *more,* with less effort — produce *more,* with fewer rejects.

See them at the Tool Show

ASTE New Era EXPOSITION

Cleveland Public Auditorium — April 8-12

BOOTH 607

Ask any tool engineer, any production man, who has used Bellows equipment, how CONTROLLED Air Power speeds production!

MODEL DF-60
DRILL PRESS FEED

MODEL CV-40B AIR VISE

Bellows AIR MOTORS—The air cylinder with the *built-in* valve, valve operating lever, and speed controls. Small, compact, powerful. Only one air connection required. Available for single, or continuous cycle operation, manual or solenoid controlled. Stroke lengths, 1" to 48". Bores to fit various thrust requirements.

Bellows AIR FEEDS—Advance work or tools a pre-determined distance, under a pre-determined thrust, and automatically return to starting position. Precision controls provide correct feeding rates, power thrust, etc., for almost any tool, any material. Both manually and electrically controlled models, with or without hydraulic checks, are available, as well as special electrical controls for continuous cycling, dwell control, drill cleaning, etc.

Bellows AIR VISES—Powered by the Bellows Air Motor, these small, sturdy, CV-40B vises may be used for a wide range of holding and clamping operations. Precision control of power thrust permits clamping pressures from virtually zero up to 500 psi or more. Vises may be easily synchronized to open and close automatically with machine movements.

The Bellows Co.

Senacon Division

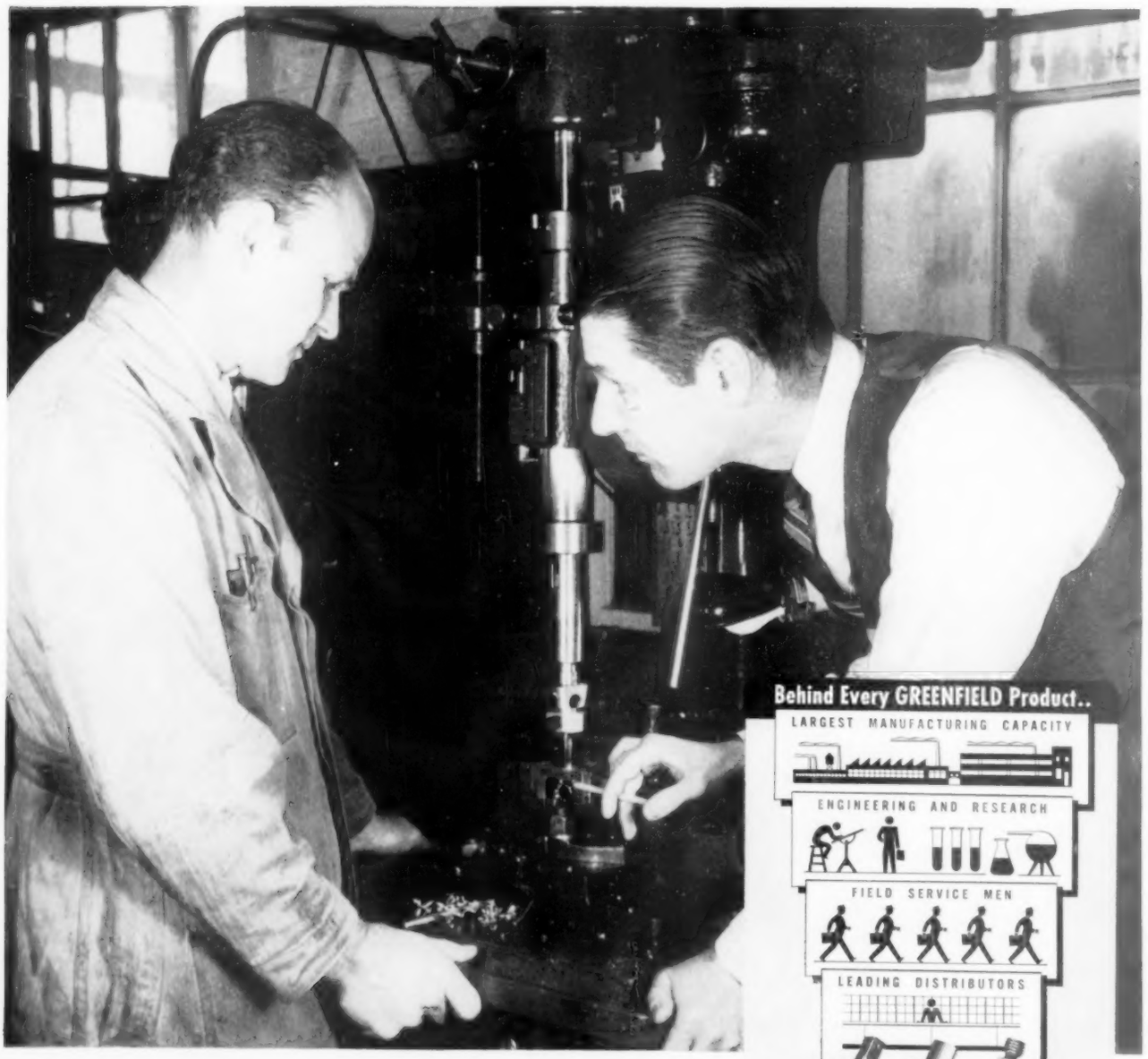
861 E. TALLMADGE AVE. AKRON 10, OHIO

"SHOW-HOW" based on "KNOW-HOW"

Each year the nation-wide staff of "Greenfield Men" save threading tool users dollars, machine downtime and broken production schedules . . . simply by "show-how". (That's "know-how" in action!)

These expertly trained men follow up sales, give advice on new jobs, and straighten out troublesome threading problems. No charge, of course.

That's another big PLUS value when you buy "Greenfield" taps, dies, and gages. You get on-the-spot service from your "Greenfield" distributor *and* the experienced "Greenfield Man" in your locality. *Such service often saves customers more money than their annual tap bill.*



GREENFIELD

GREENFIELD TAP and DIE CORPORATION

GREENFIELD, MASSACHUSETTS

INGERSOLL FACE MILL CUTTERS

Available from Stock

TYPE NX Heavy Duty Series face milling cutters designed for geneal purpose work are suitable for taking ½" cuts on both the face and periphery in cast iron or steel. Serrated high speed steel blades are locked in the cutter housing by wedges and screws. Chip clearance is milled in the housing to prevent chips clogging on heavy cuts. The following sizes are available in stock both right and left hand.

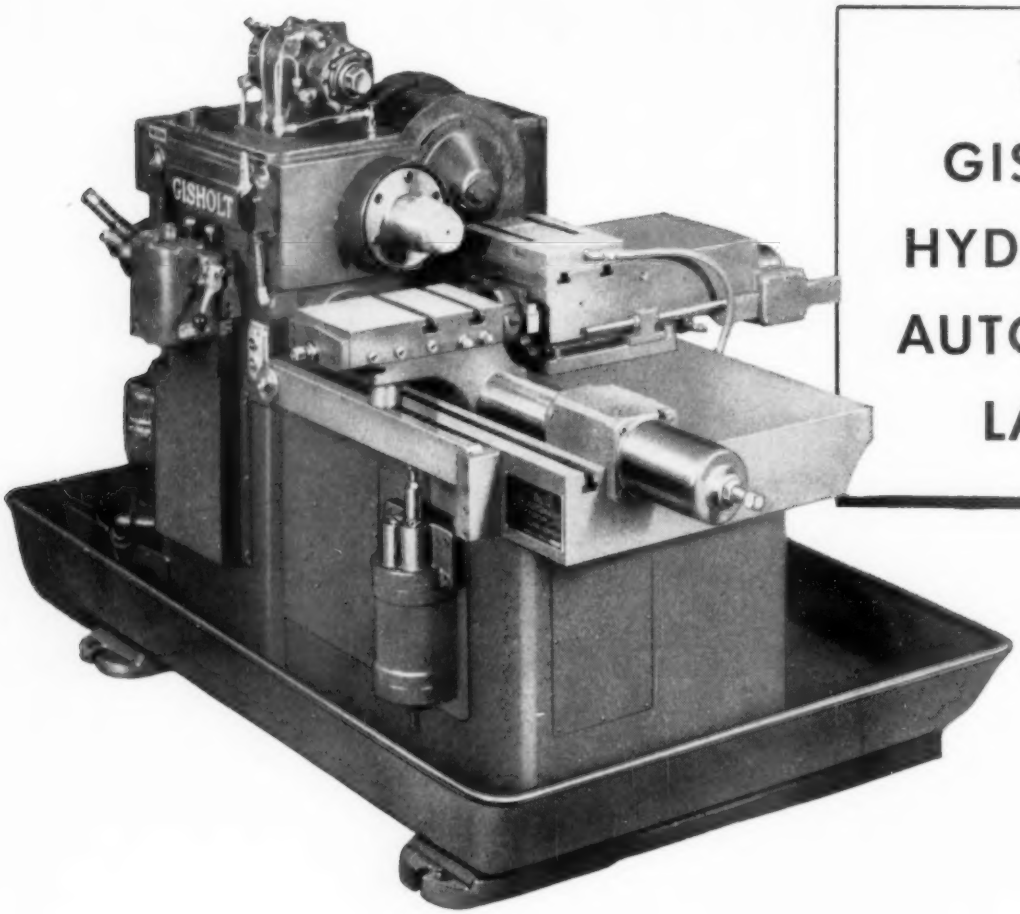
Cutter No.	Diameter	No. Blades	Cutting Face on Periphery	Price
8104X	4"	10	1-¾"	$30.00
8106X	6"	10	2-½"	35.00
8108X	8"	14	2-½"	45.00
8110X	10"	18	2-½"	60.00
8112X	12"	20	2-½"	78.00

SHEAR CLEAR Heavy Duty Series face milling cutters will out-perform any existing designs for work in tough steel and in the soft, stringy, non-ferrous metals. Designed for ½" deep cuts. The Shear Clear is a patented design using steep negative rake and positive shear angles which cause chips to coil outward away from the cutter. The following sizes with high speed steel blades are available in stock both right and left hand:

Cutter No.	Diameter	No. Blades	Price
7106X	6"	12	$58.00
7108X	8"	16	75.00
7110X	10"	20	100.00
7112X	12"	22	120.00

Write for catalog giving complete details on inserted blade milling and boring tools.

THE INGERSOLL MILLING MACHINE CO., ROCKFORD, ILLINOIS



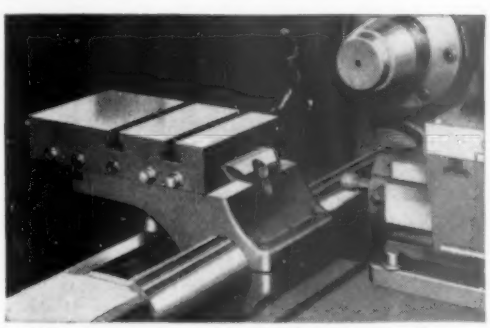
The GISHOLT HYDRAULIC AUTOMATIC LATHE

WHY IT HANDLES MORE JOBS

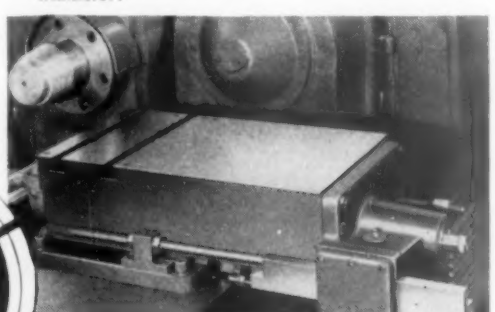
more easily

The reasons for the remarkable versatility of the Gisholt Hydraulic Automatic Lathe lie in its extremely simple design. And this simplicity also accounts for its easy change-over from job to job.

1. There is no changing of cams and gears for different jobs.
2. The front carriage can be clamped in any desired position, making it easy to arrange tooling to best advantage.
3. By simple nut adjustment, there is an infinite variety of feeds from .000" to .058" for either front or rear carriage.
4. Rapid traverse and feed stops are quickly and easily changed by simple, single screw adjustments.
5. In partial trial cuts, in change of set-up, it is not necessary to run the machine through its entire cycle. Front or rear tools may be operated separately and independently—may be arrested at any point and returned to starting position.



Note how front carriage is clamped upon a heavy, horizontal, circular bar. The wide, heavy top with T slots, permits mounting standard or special tool blocks in various arrangements. A graduated micrometer screw is provided for adjusting tools to diameter.



This rear slide is a complete self-contained unit which can be readily mounted in any position, to feed in any direction, and at any desired rate of feed.

The outstanding versatility of the Gisholt Hydraulic Automatic Lathe may be applied to a wide variety of chucking, between-centers and fixture-held work. Write for complete information.

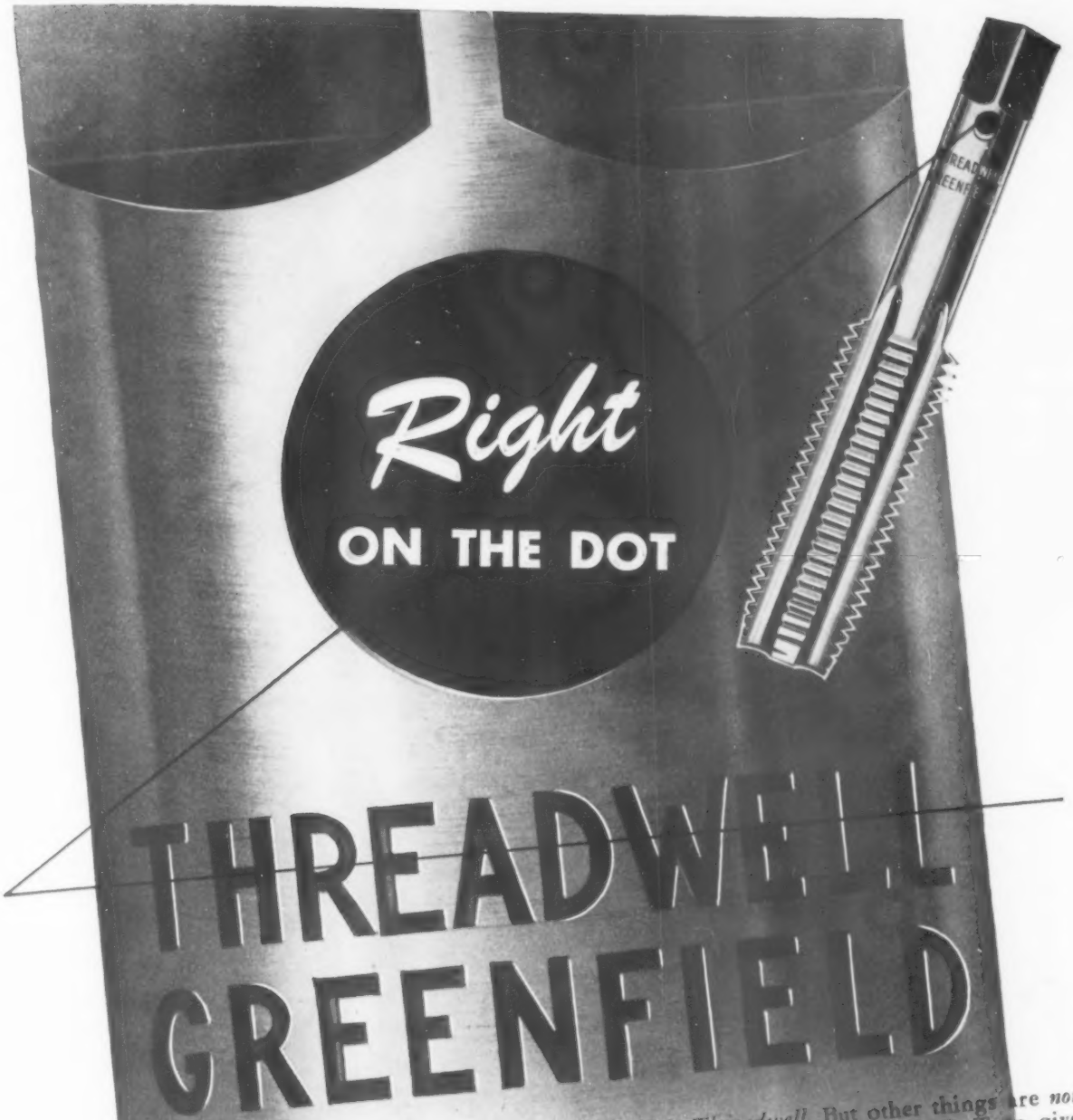
GISHOLT MACHINE COMPANY

1257 East Washington Ave. • Madison 3, Wisconsin

Look Ahead . . . Keep Ahead . . . With Gisholt Improvements in Metal Turning

GISHOLT

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES



Color *i-dot-ification* is an exclusive feature of Threadwell COLD-TEMPER Taps — *red* dot for high speed cut thread, *white* dot for commercial ground, *blue* dot for precision ground.

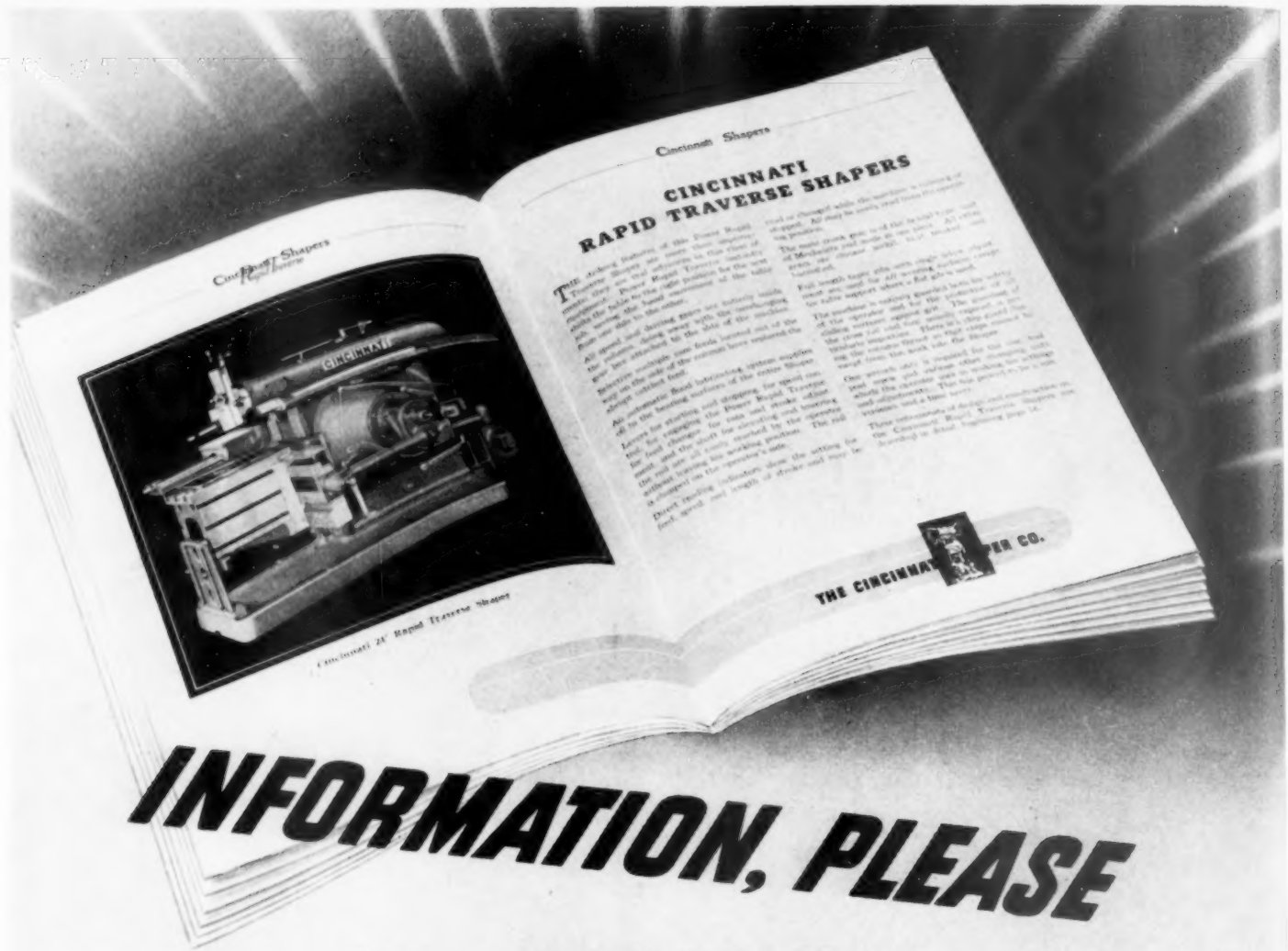
Other things being equal, color *i-dot-ification* is a convenience feature that makes it worth while to specify *Threadwell*. But other things are *not* equal. Threadwell COLD-TEMPER Taps give you cleaner, more uniform, more accurate threads and *more of them per tap*. All we ask is that you try them and find out for yourself. Your local Threadwell distributor is prepared to provide *personal attention* to your tap needs.

"DISTRIBUTORS IN LEADING INDUSTRIAL CENTERS THROUGHOUT THE UNITED STATES AND THE WORLD"

Threadwell
SINCE 1902
"TAPS OF DISTINCTION"

THREADWELL TAP AND DIE COMPANY · GREENFIELD, MASSACHUSETTS, U. S. A.

CALIFORNIA OFFICE, THREADWELL TAP & DIE CO. OF CALIF., 1322 SANTA FE AVE., LOS ANGELES 21



INFORMATION, PLEASE

Today, as ever, Cincinnati Shapers are indispensable in both the large plant and the small shop. Such Cincinnati features as built-in power rapid traverse to the table, multiple cam feeds, direct reading indicators bring to the user of a single machine or of many machines an outstanding usefulness.

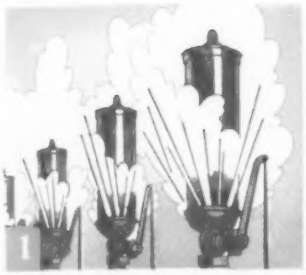
Write for informative book N-3 on the complete line of Cincinnati Shapers.

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO U.S.A.

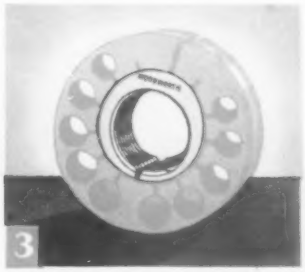
SHAPERS · SHEARS · BRAKES

Holy Smokes! They've done it again!



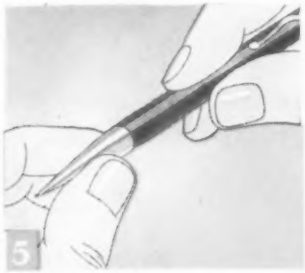
Blow all the whistles! They've done it again!

Blast out a fanfare for a great new Woodworth invention!

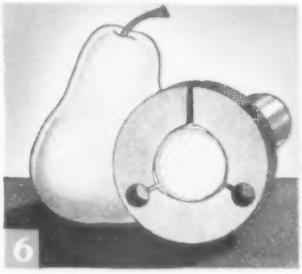


It's the Woodworth Adjustable Thread Ring Gage.

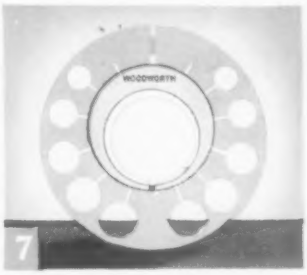
Thread ring gages check the O.D. of threaded parts.



Adjusting 'em as they wear down saves time and money.

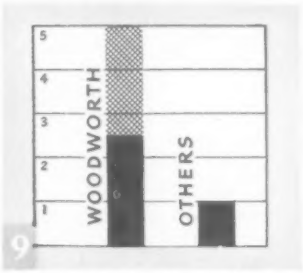


But old types get pear-shaped —lose accuracy—wear out fast.

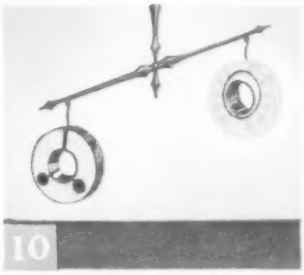


This Thread Ring Gage adjusts perfectly — *stays round.*

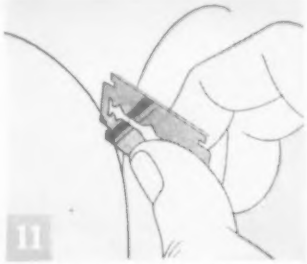
Never gets out of line when dropped or thrown about.



Equal distribution of wear increases life 2½ to 5 times.



Light weight reduces operator fatigue — increases sensitivity.



It's amazingly accurate . . . ideal for hair-splitting work.

Woodworth's New Thread Ring Gage is an all-time champion!

Another Woodworth contribution to production

THE NEW Adjustable Thread Ring Gage, another revolutionary Woodworth instrument of accuracy, is now available to industry!

Employing an entirely new principle of design, and proven mathematically correct by actual tests, this gage assures roundness through the maximum range of adjustment.

Check these
Five Important Advantages

1. *Greater Accuracy and Stability.* Stays round with adjustment. Threads held in alignment of thread helix angle with adjustment. Will not reject parts that should pass inspection.

2. *Longer Wear Life.* Equal distribution of wear over the full thread circumference, throughout the entire range of adjustment, increases wear life 2½ to 5 times.

3. *Less Weight.* Aluminum alloy outer body halves the weight to greatly reduce operator fatigue and increase sensitivity.

4. *Positive Identification.* Green outer body for GO GAGE and red for NOT GO GAGE saves time for operator.

5. *Positive Adjustment.* Cannot be thrown out of adjustment by ordinary blows or falls that change setting of conventional gages.

You can speed up production and decrease gaging costs on your thread inspection operations with this amazing instrument! Write for completely illustrated folder 46-R.

ACCURACY YOU W CAN TRUST

WOODWORTH

N. A. WOODWORTH CO., SALES DIVISION, 1300 E. NINE MILE ROAD
DETROIT 20, MICHIGAN

PRECISION GAGES

PRECISION MACHINED PARTS

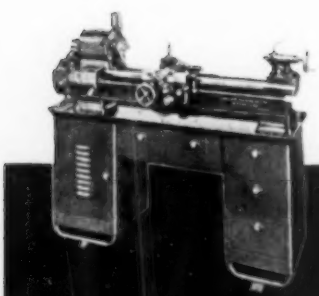
DIAPHRAGM CHUCKS—SPECIAL TOOLS

ADJUSTABLE CLAMPING JIGS

YOU DON'T USE A SLEDGE TO DRIVE TACKS

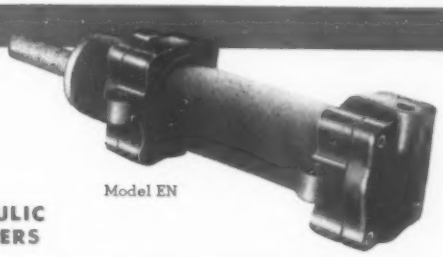
There was a time when machine tools had to be heavy to be accurate but modern engineering and manufacturing methods have changed that. Today, the fully equipped shop has its big lathes for big work, and SHELDON S-56 Precision Lathes for small parts. With accuracy that will hold the closest tolerances and the stamina to stand up to continuous high speed operation, these smaller, handier, moderate priced lathes are cutting the cost of and increasing the hourly output of small turned parts.

FROM ANY ANGLE, A BETTER LATHE.



SHELDON MACHINE CO., INC.
4229 N. Knox Ave., Chicago 41, U.S.A.

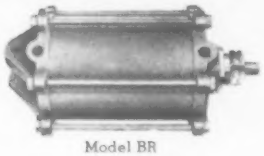
HANNIFIN PNEUMATIC AND HYDRAULIC EQUIPMENT



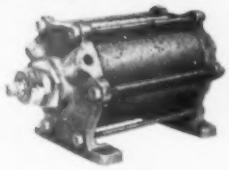
Model EN

HYDRAULIC CYLINDERS

with patented "no-tie-rod" design, providing a stronger cylinder assembly, simpler to apply, assuring high efficiency operation. End caps may be positioned independently, without disturbing mounting for simple, efficient piping. Mirror finish honing gives a cylinder bore that is straight, round, perfectly finished. High efficiency piston seal with minimum fluid slip is assured. Seven standard mounting types; special mountings and large sizes built to order.



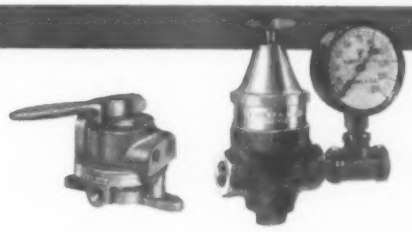
Model BR



Model CR

PNEUMATIC CYLINDERS

provide simple outside adjustment of the soft piston packing, allowing easy maintenance of the high efficiency piston seal with minimum friction loss. All sizes are bored and honed for straight, round, mirror finish cylinder bore—a better finish that means better cylinder performance. Built in a full line of standard mountings, sizes 1 to 16 inch bore, for any length stroke, with or without cushion.



AIR CONTROL VALVES

disc type for positive, accurate control of air operated equipment. Efficient disc type design without packing prevents leakage and waste of air power, does away with packing maintenance troubles. The bronze disc controlling air flow is ground and lapped to make a perfect seal with the valve seat. Made in 3-way and 4-way types for control of single and double acting cylinders in hand or foot models, spring return, heavy duty rotary, manifold, and electric models. Also piston type pressure regulating valves.

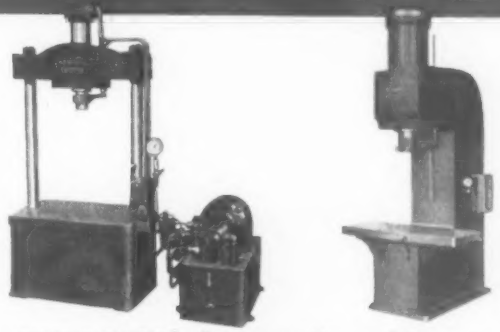
"HY-POWER" HYDRAULIC RIVETERS

for high speed production riveting, punching, pressing. Portable and stationary types available, designed for easy handling and consistent rapid production. Capacities 7½ to 100 tons. The automatic operating cycle is push-button controlled and includes rapid advance stroke, automatic high pressure working stroke, automatic reversal, rapid return stroke. The hydraulic pressure generator is a compact motor driven unit. "Hy-Power" equipment is adaptable to a wide range of riveting, punching, and pressing operations.

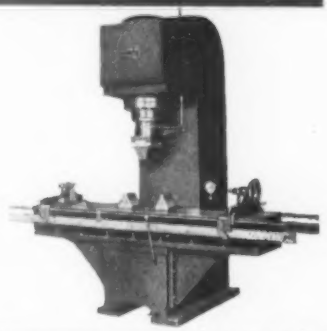
HYDRAULIC PRESSES

available in 2, 3, 4 column, and open gap types, capacities 5 tons to 150 tons, for straightening, forming, press assembly and similar operations involving the application of pressure. Column spacing, ram stroke, table construction, speeds, and controls may be readily modified to suit individual needs.

COLUMN TYPE available in a wide range of types and sizes. This 10 ton two column press with sensitive pressure control is ideal for accurate pressing and assembly operations.



FORCING PRESSES built in many sizes and types, with control and table design to suit individual needs. This 75 ton press has sensitive pressure control and is adapted to general press-fit assembly, forcing and forming operations.



STRAIGHTENING PRESSES designed for rapid, accurate production straightening. This 100 ton press has sensitive pressure control, long table and center type fixture.

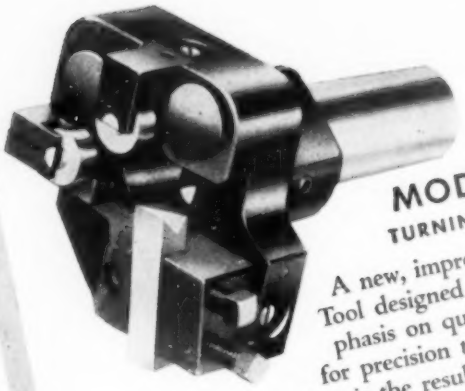
HANNIFIN MANUFACTURING COMPANY • 621 S. KOLMAR AVENUE • CHICAGO 24, ILLINOIS

MAXIMUM SCREW MACHINE PRODUCTION

— Closer Tolerances
— Finer Finishes
— Less Rejects

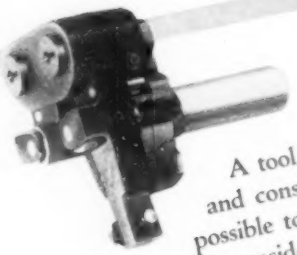
BOYAR-SCHULTZ SCREW MACHINE TOOLS

Promote lower operating costs . . . superior quality at competitive price . . . designed for quick set-up . . . sturdily built for long life.



MODEL T
TURNING TOOL

A new, improved Screw Machine Tool designed with special emphasis on quick accurate set up for precision turning. Less down time is the result of speedy adjustment. Model T Screw Machine Tool is made in five sizes, Nos. 000, 00, 0, 2 and 3.

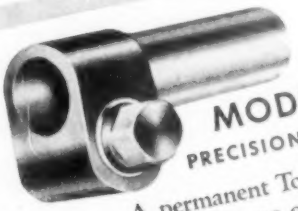


MODEL K
KNURLING TOOL FOR TURRET TYPE SCREW MACHINES

A tool of outstanding design and construction, making it possible to perform many of the knurling jobs considered impossible with tools of other types. Built on a new principle; speedy in operation, giving clean, accurate knurling in a minimum of time.

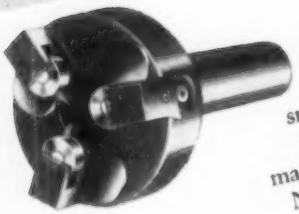
MODEL D
FLOATING TOOL HOLDER

For reaming, counter boring, and drilling to close tolerances. Made in 8 sizes, No. 000 to No. 6



MODEL H
PRECISION ADAPTER

A permanent Tool that permits the use of more than one size screw machine tool on a given size screw machine. Made in 6 sizes.



MODEL C
BURNISHING TOOL

For producing a surface smoother than is usually possible with the ordinary machining processes. In 3 sizes, No. 00, No. 0 and No. 2.

MODEL G
UNIVERSAL TOOL BIT GRINDING FIXTURE

Tool Bits can be accurately and uniformly ground with any desired chip clearance angles. Uniformly ground tool bits save time in set-up, save tool steel and save time in grinding.

VISIT OUR BOOTH
ASTE SHOW
CLEVELAND
APRIL 8th to 12th
BOOTH No. 711

BOYAR-SCHULTZ CORPORATION 2116 WALNUT STREET CHICAGO 12, ILLINOIS

Why all Production Men should attend the

ASTE

NEW ERA EXPOSITION

1. Thousands of new tools and new production methods have been devised during the past few years.

2. Many of these have been tied up with military secrets—or their wider use limited by production restrictions.

3. New ideas by the hundred will be shown *for the first time* at the ASTE Exhibition.

4. Here is every production man's opportunity to see how the latest production methods and tools will help solve the shop problems of today and tomorrow.

5. Remember the date—April 8-12, 1946—and the place—Cleveland's Public Auditorium.

SEE US AT

BOOTH 1219

★

"COME IN AND SET A WHILE"

PMCO

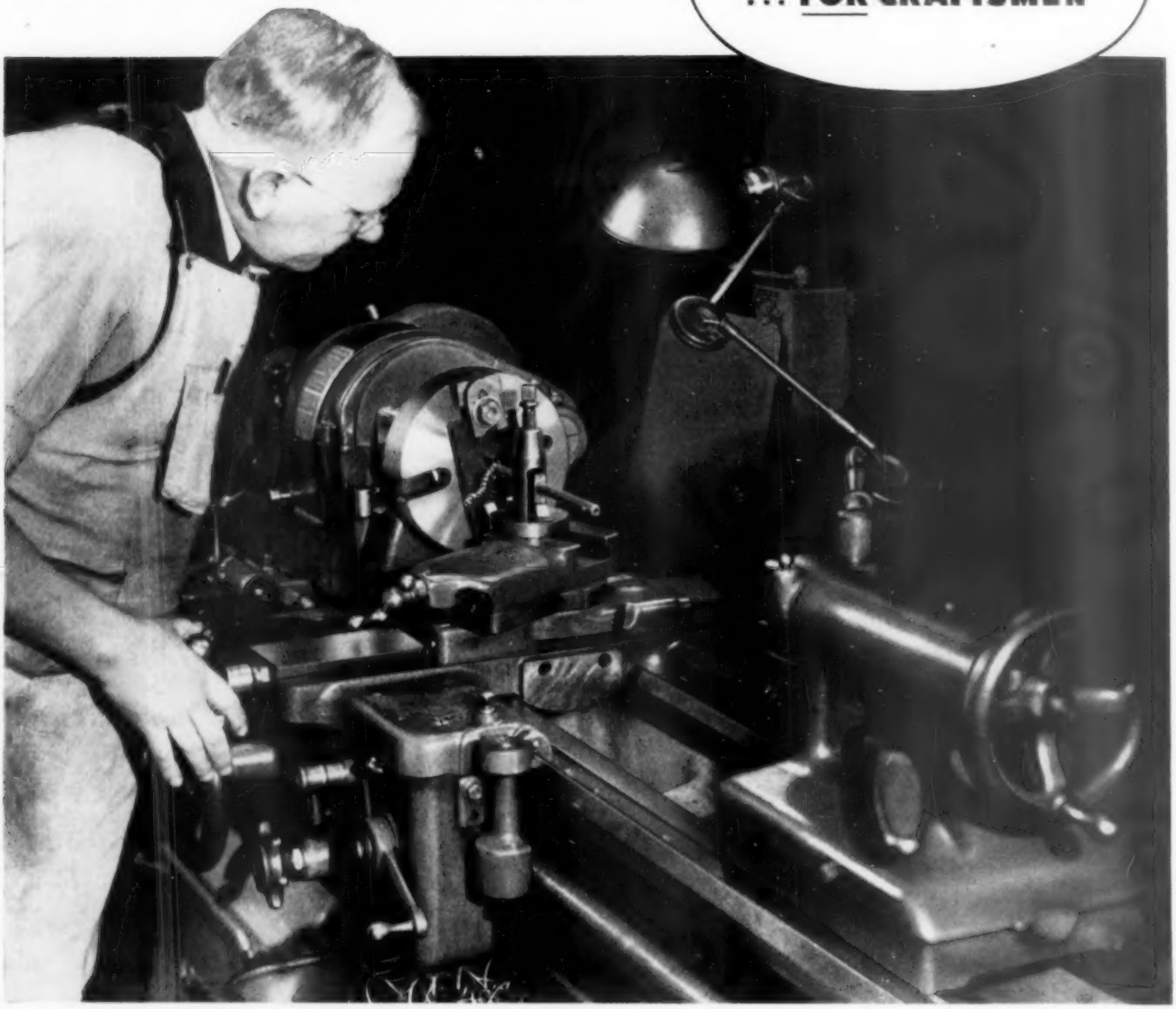
ARMY E NAVY

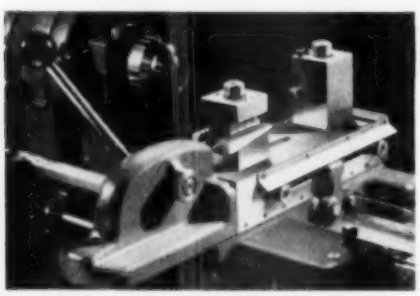
The PIPE MACHINERY COMPANY Cleveland, O.

GAGES • HOBS • MILLING CUTTERS • SPECIAL TOOLS

South Bend Lathes

BUILT BY CRAFTSMEN
... FOR CRAFTSMEN





BROADEN THE SCOPE OF YOUR LATHES
South Bend Attachments and Accessories simplify the tooling of South Bend Lathes for special types of precision work. Write for Catalog 77.

Iron, steel, brass, bronze, and other vitally important materials used in the construction of South Bend Precision Lathes, are carefully selected for grade and quality. Just as important as these quality materials is the readily recognizable craftsmanship which goes into the making of these versatile machine tools. It is this craftsmanship—the keen perception, care, skill, and precision workmanship of men who take pride in their craft—which helps to make South Bend Lathes the fine, dependable, precision tools that they are.

Made by craftsmen for the use of craftsmen in whose work fine precision is essential, South Bend Precision Lathes will give you complete satisfaction in all your toolroom and production needs. Write today for Catalog 100-D which illustrates in full color and describes all sizes of South Bend Precision Engine, Toolroom, and Turret Lathes.

SOUTH BEND LATHE WORKS
531 EAST MADISON STREET • • SOUTH BEND 22, INDIANA
LATHE BUILDERS SINCE 1906

DIAMONDS IN A

New and Improved Vitrified Bond

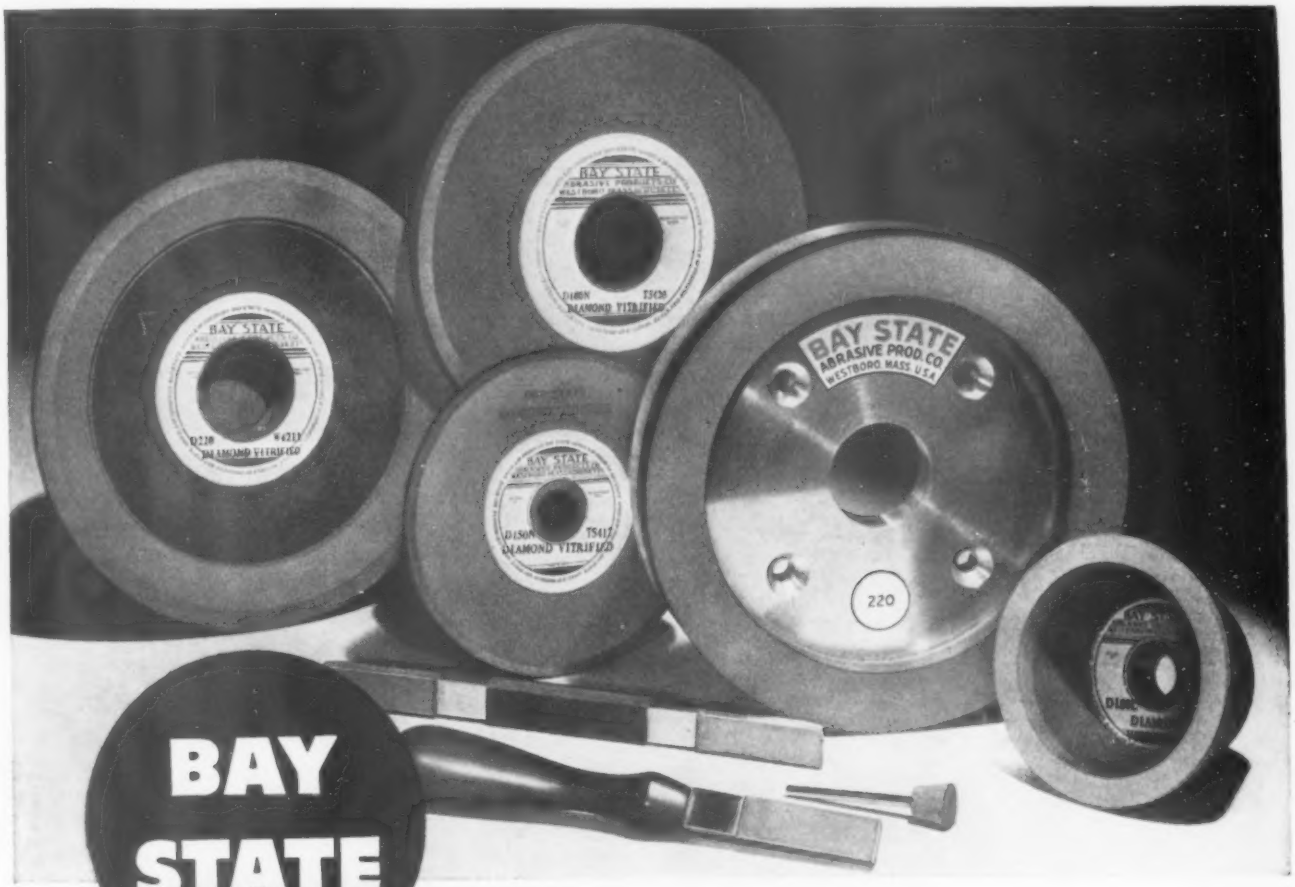
A new vitrified bond designed expressly for diamond abrasive makes a lusty new champion in the grinding of cemented carbide tools and other super-hard substances! The Bay State line of diamond abrasives (resinoid bonded, excellent for many precision and form-grinding operations; and metal bonded, best suited for off-hand grinding jobs) is now supplemented by a new *vitrified* bond.

Considerable research and experiment, together with thorough testing in actual use, have proved the superiority of this Bay State development. Now, the unparalleled abrasive power of diamonds gains the advantages of vitrified bonding — great strength and rigidity, plus faster, cooler cutting action. Results are long life, hair-fine accuracy and lower grinding cost per tool — important additions to the already high economy and efficiency of diamond abrasive grinding.

Typically, Bay State makes available to you this latest achievement, in a wide range of standard shapes and sizes . . . every one of them built to uphold Bay State's record of *top performance consistently duplicated.*

Write for Bulletin #1980, containing full information on Bay State Resinoid, Metal and Vitrified Bonded Diamond Abrasives.

BAY STATE ABRASIVE PRODUCTS CO.
9 Union Street, Westboro, Mass.



BAY STATE

ABRASIVE PRODUCTS

Top Performance Consistently Duplicated

GRINDING WHEELS · HONING AND SUPERFINISHING STONES · PORTABLE SNAGGING WHEELS
MOUNTED WHEELS AND POINTS · CUT-OFF WHEELS · INSERTED-NUT DISCS AND CYLINDERS

Gear Finishing

Gear Cutting

THE GEAR CUTTING TWINS

Ever since the introduction of crossed-axis gear finishing, there has been a crying need for a gear cutting machine which could keep pace—gear for gear—with the output of gear finishers like the Michigan 900.*

This need has now been filled with the introduction of the new line of Michigan SHEAR-SPEED gear shapers which will cut gears as accurately as they can be cut by *any* high production gear cutting machine and cut them *as fast as you can finish them.*

One SHEAR-SPEED and one Michigan Gear Finisher thus represent a gear-cutting "UNIT". You can now plan your gear production in "Units" per hour or per day.

In addition, you save countless machine hours, and produce better gears at lower cost.

For further information on the GEAR CUTTING TWINS, ask for Bulletins:

#1800-45—describing the new SHEAR-SPEED machine

#900-44—covering the Michigan 900 Gear Finisher*

*Rotary gear finishers also available. For recommendation of type best suited to your needs specify your gear production requirements.

ORIGINATORS of GEAR SHAVING

MICHIGAN TOOL COMPANY

7171 E. McNICHOLS ROAD DETROIT 12, U. S. A.

NOW AVAILABLE..Production Tested...

haskins NEW ALL-PURPOSE TAPPING MACHINE

Electric-Air Control is standard equipment on the new Haskins high speed tapping machines. Completely redesigned, these fully universal machines provide every conceivable method of control and allow free interchange of any type of holding fixture—hand fed or automatic.

Electric-Air increases sensitivity in the application of power, permits accuracy in depth of stroke, satisfies the most exacting requirements. Solenoid valves offer automatic or controlled cycle of operation, allow the synchronizing of holding fixtures with the stroke of the tap head.

All in all, the Haskins Electric-Air Controlled Tapper is certain to become a most important development in modern tapping history. Send for details.

And, in addition, a new heavy duty machine.

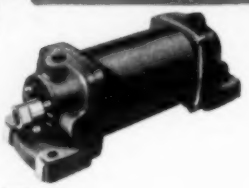
R. G. HASKINS CO. • 2741 W. Flournoy St. • CHICAGO 12, ILLINOIS

HASKINS

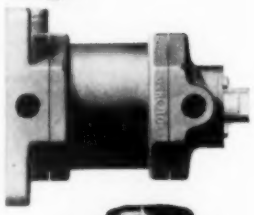
haskins **ELECTRIC - AIR CONTROLLED TAPPING EQUIPMENT**

GEROTOR Serves You With a... COMPLETE Line for Your

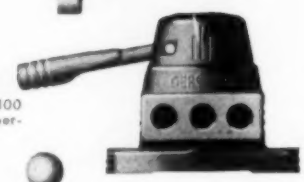
AIR AND HYDRAULIC SYSTEMS



Gerotor Model 111 Foot Mounted double-acting, non-rotating Air Cylinder.

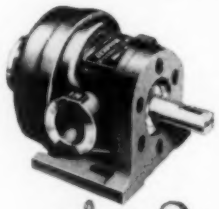


Gerotor Model 241 Blind End Flange Mounted, double-acting Hydraulic Cylinder.



Gerotor Model 2100 Four Way Hand operated Air Valve.

Gerotor Model 5100 hand operated Four Way Hydraulic Valve.



Gerotor Series "H" single unit, plain mounting Hydraulic Pump.

Gerotor Model 9100 Hydraulic Pump Unit.

AIR CYLINDERS

Designed for 150 P.S.I. air and 300 P.S.I. oil or water service. Double-acting, non-rotating type offered in 7 mounting styles, twelve bore diameters, any length stroke, and with cushioning feature. Special models supplied. Rotating type of aluminum alloy body available for 3600 R.P.M. service.

HYDRAULIC CYLINDERS

Designed for 750 P.S.I., 1500 P.S.I., and 3000 P.S.I. oil or water service. Double-acting type available in 7 mounting styles, ten bore diameters, any length stroke, and with cushioning feature. Special models supplied. Rotating cylinders available for 500 P.S.I. oil service.

AIR VALVES

Designed for pressures up to 150 P.S.I. in 5 types of operation: hand, foot, cam, solenoid, and remote. 5 sizes available: ¼", ⅜", ½", ¾" and 1". Special models supplied to your special order.

HYDRAULIC VALVES

Designed for pressures up to 1500 P.S.I. in 6 types of operation: hand, foot, cam, solenoid, oil pressure, and air pressure operated. 7 sizes available: ¼", ⅜", ½", ¾", 1", 1-¼" and 1-½". 5 piston designs for any hydraulic circuit. Special models supplied.

HYDRAULIC PUMPS

Single pumps for oil service are available in 3 series, with capacities from .4 G.P.M. to 40 G.P.M. and more, up to 1000 P.S.I. Double pumps available in 4 series covering wide range of delivery and pressure combinations. All pumps can be had with plain, base, or flange mounting.

HYDRAULIC PUMP UNITS

Available in 5 tank sizes, with oil pump capacities from .4 G.P.M. to 40 G.P.M. and more, at pressures up to 1000 P.S.I.

"GRIP TUBE" FITTINGS

Seal higher fluid pressures and absorb excessive vibrations. Available in variety of styles for every installation need.

WORK HOLDING DEVICES

Precision built, quick-acting mandrels and collet chucks increase production speeds and minimize operator fatigue. Air and hydraulic operated.

GEROTOR MAY CORPORATION
LOGANSPORT, INDIANA
PLANTS AT BALTIMORE, MD., LOGANSPORT, IND.

YOU WILL SEE THE COMPLETE GEROTOR LINE AT BOOTH 1422
ASTE NEW ERA EXPOSITION, APRIL 8 TO 12, CLEVELAND, OHIO

HIGH SPEED STEELS

HIGH SPEED STEELS *

Red Cut Superior

America's favorite high speed steel—for all cutting purposes.

E. V. M.

For fine cuts and hard materials—higher carbon and vanadium content.

Red Cut Cobalt

For hogging cuts, fast speeds, hard or scaly materials, etc.

Gray Cut Cobalt

Provides the highest attainable cutting ability in a high-speed steel.

Neatro

Remarkably wear-resistant, delivering top performance on abrasive materials.

6-6-2

For fine edge tools and finishing cuts. Wide hardening range.

Vasco M-2

A tungsten-molybdenum general purpose steel, particularly adapted to fine finishing cuts.

Victory Cobalt

For heavy duty cutting of heat treated steel, cast iron, etc.

All of the above steels are available in billets, bars, cold drawn shapes, solid forgings, ring forgings, sheet, plate, circles, drill rod and tool bits.

* One of the series of six Vasco Tool Steel Classifications covering every industrial requirement.

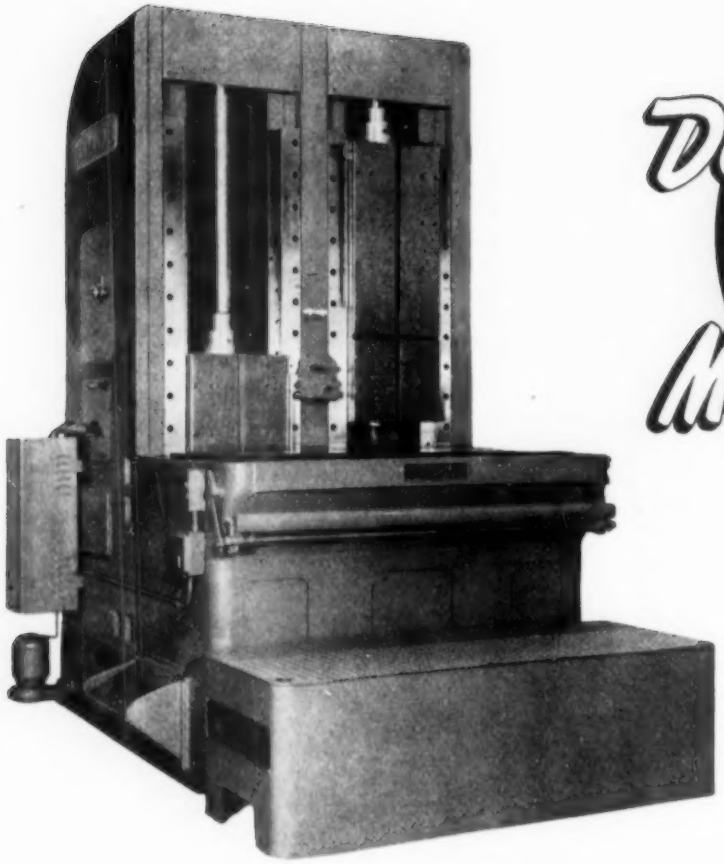
Vanadium-Alloys

STEEL COMPANY

LATROBE, PENNA.

COLONIAL STEEL DIVISION

ANCHOR DRAWN STEEL CO.



Designed to Cut TODAY'S Machining Costs

At Left: Dual ram machine without tooling.

Below: Typical single ram type.

THE IMPROVED SINGLE AND DUAL RAM SURFACE BROACHING MACHINES BY

Colonial

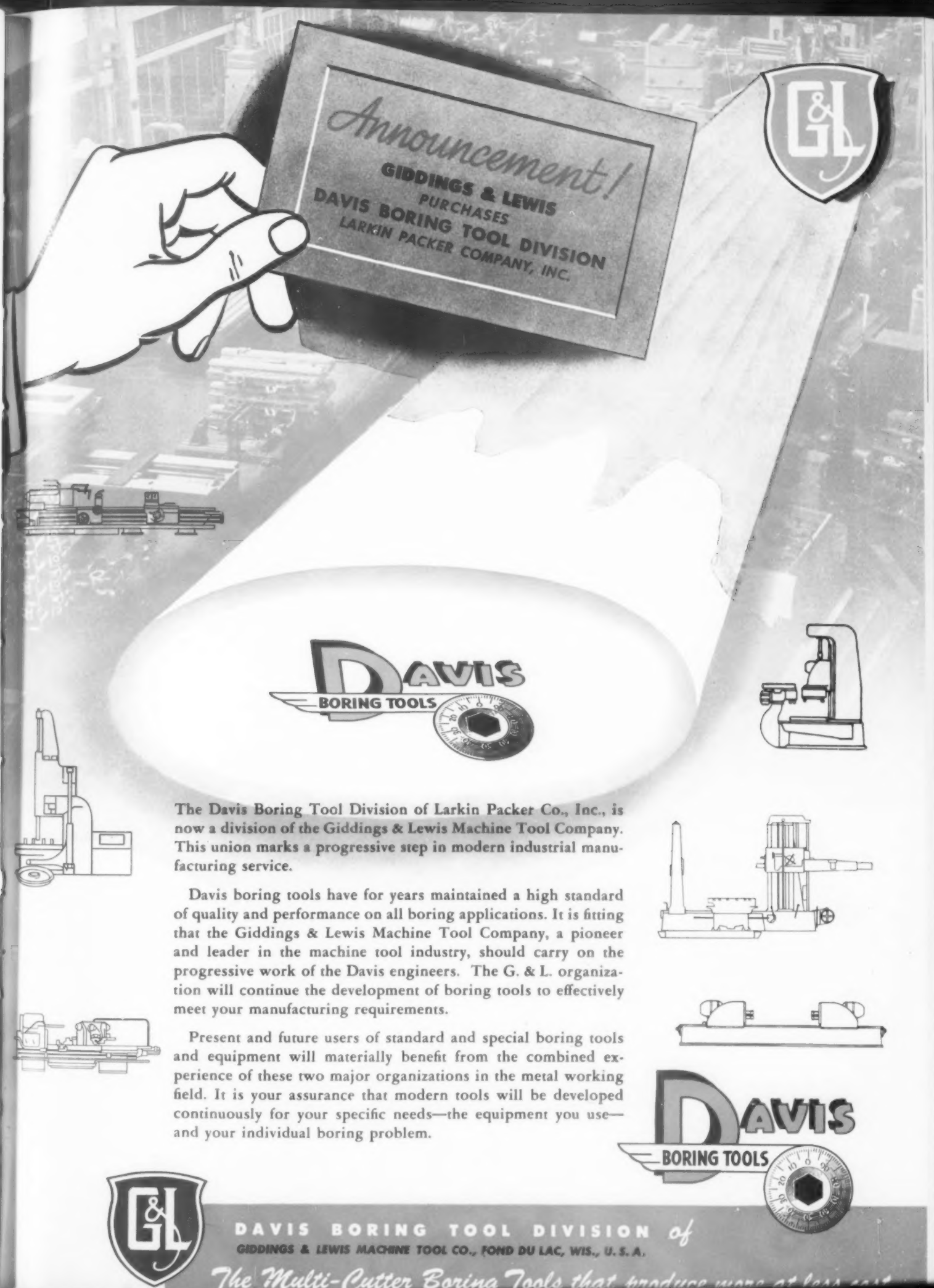
Even before the war, Colonial Hydraulic Single and Dual ram surface broaching machines had become the leaders in their field—mass production machining of outside surfaces at the lowest cost per piece.

Excess capacity for heavy duty jobs, maximum freedom from service trouble in continuous operation, rigidity to prevent deflection and maintain accuracy, provision for shuttling or other forms of automatic retracting loading tables, speed adjustable to meet the specific need for any given job, dual safety controls plus emergency knee-bar stop. These are just a few of the features built into every Colonial Single and Dual Ram Machine, whether they be of light tonnage with *minimum* stroke or heavy duty with *maximum* 66" stroke.

colonial BROACH COMPANY

DETROIT 13, U.S.A.

Broaches Broaching Machines - Broaching Equipment



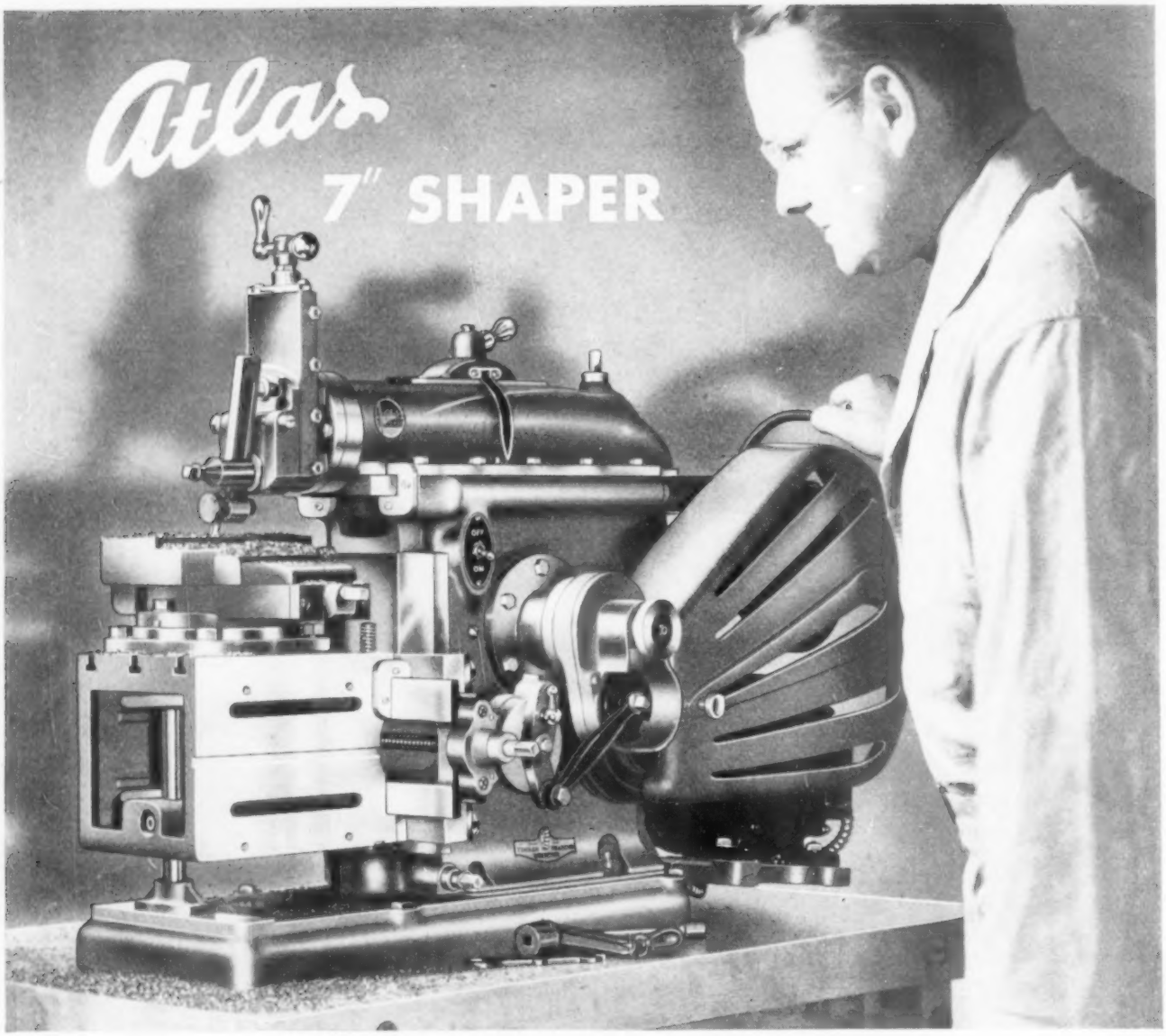
The Davis Boring Tool Division of Larkin Packer Co., Inc., is now a division of the Giddings & Lewis Machine Tool Company. This union marks a progressive step in modern industrial manufacturing service.

Davis boring tools have for years maintained a high standard of quality and performance on all boring applications. It is fitting that the Giddings & Lewis Machine Tool Company, a pioneer and leader in the machine tool industry, should carry on the progressive work of the Davis engineers. The G. & L. organization will continue the development of boring tools to effectively meet your manufacturing requirements.

Present and future users of standard and special boring tools and equipment will materially benefit from the combined experience of these two major organizations in the metal working field. It is your assurance that modern tools will be developed continuously for your specific needs—the equipment you use—and your individual boring problem.

DAVIS BORING TOOL DIVISION *of*
GIDDINGS & LEWIS MACHINE TOOL CO., FOND DU LAC, WIS., U. S. A.

The Multi-Cutter Boring Tools that produce more at less cost



QUICKER SET-UPS on SMALL PARTS Operations

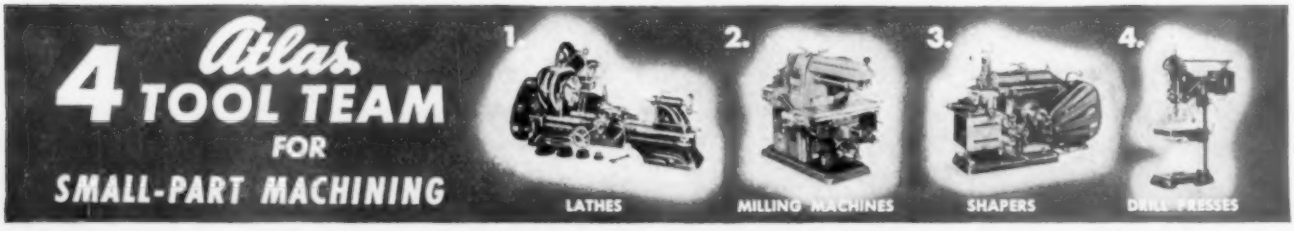
"Match the machine to the job" is an idea that is especially valuable in shaping operations. Most of them are within the 7" stroke of the Atlas shaper. You can save considerable on set-up time, machine hour and power costs with this compact, low cost tool.

The Atlas shaper handles close tolerance work to perfection. Gives you a selection of cutting strokes between 45 and 186 per minute, speeds from 3½ to 116 fpm. It is Timken bearing equipped. Operates from ½ HP motor.

Send for catalog with complete specifications and operating details.

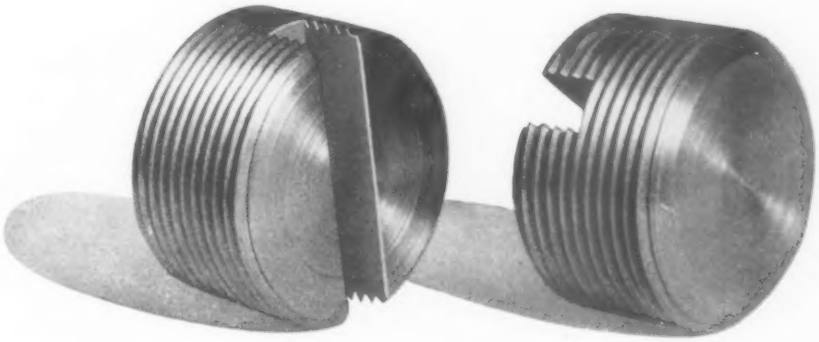
ATLAS PRESS COMPANY

314 North Pitcher Street, Kalamazoo 13D, Michigan



STEP NO. 1

in selling more goods



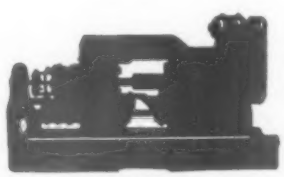
Look at this typical example of Acme-Gridley cost reducing practice.

Here is a steel automotive part, $1\frac{1}{4}''$ diameter, turned from bar stock on a $1\frac{5}{8}''$ Acme-Gridley Bar Automatic. 10 operations include threading by $1\frac{1}{16}''$ Vers-o-tool with ground thread circular chasers, slotting by rotating attachment, and pick-off for fine finish on the cutoff. No secondary operations necessary — no additional machines required.

Total machine time for 10 operations is 14 seconds—machine production exceeds 250 per hour, with required precision positively assured.

Savings like this help you in two ways—(1) they enable you to reach broader markets through better competitive selling prices, and (2) they help you to protect normal profits on existing sales volume.

For whatever parts you need in production quantities, we suggest that you let our engineering department show you today's methods of getting costs down.

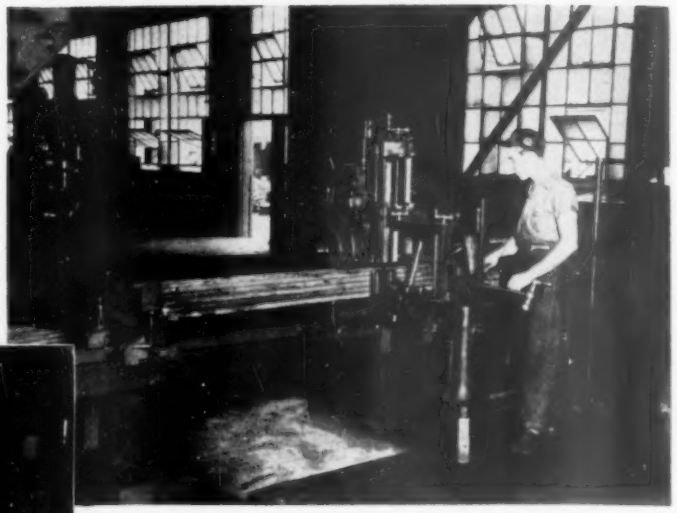


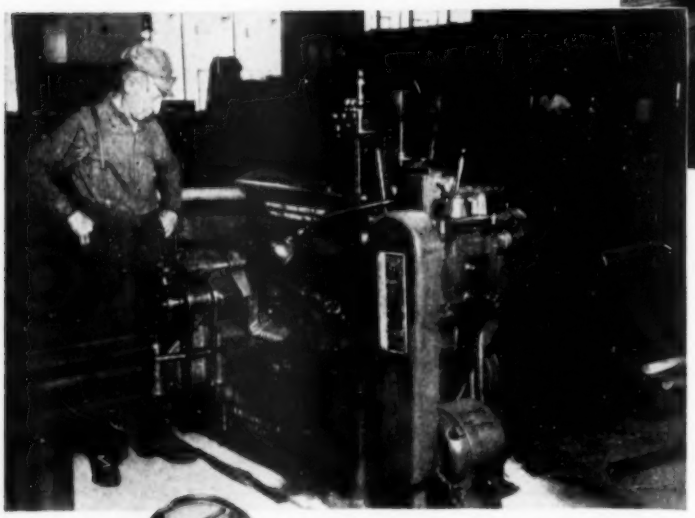
ACME-GRIDLEY
BAR and CHUCKING AUTOMATICS
Maintain accuracy at the highest spindle speeds and fastest feeds modern cutting tools can withstand.

THE NATIONAL ACME COMPANY

170 EAST 131st STREET · CLEVELAND 8, OHIO

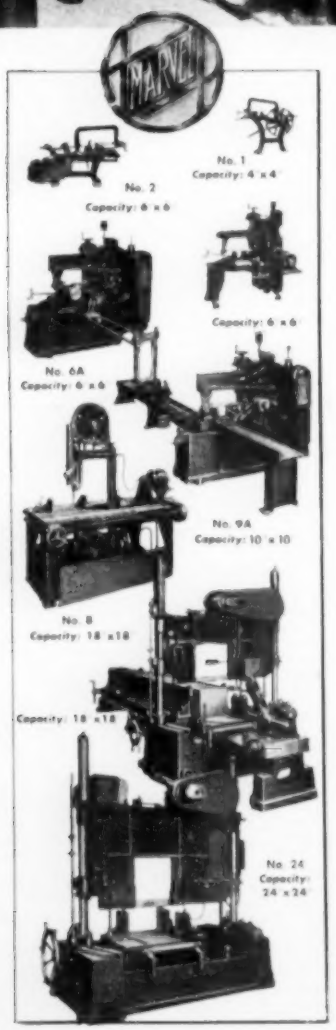
RAILWAYS ARE *Streamlining* THEIR SHOPS TOO!





(*Above*) MARVEL No. 9A Production Saw automatically cutting-off hollow iron into staybolts; 1" x 9", 30 bolts to the cut.

(*Left*) Cutting accurate lengths from 3½" steel tubing for spring and brake hanger bushings.



Railway shops are "re-converting," not to new products but to newer and more efficient methods.

Today, in the Paducah shops of the Illinois Central, for example, much cutting-off work is being done with MARVEL No. 9A Production Saws that feeds, measure and cut off identical lengths automatically with no more operator attention than is required by an automatic screw machine.

Operating "automatically," the Marvel No. 9A Saw illustrated above, has cut-off as many as 300 pieces of 1" round staybolt stock in a single hour. Supervision at the Paducah shops tell us that the machine paid for itself in the first 30 days and has been piling up dividends ever since. These extremely accurate and fast saws are not limited to production cutting-off work, because at any point in a "run," the automatic bar push-up can be dis-engaged, a miscellaneous cut made, and the production run resumed by merely re-engaging the bar push-up clutch.

The MARVEL System of Metal Sawing comprises 9 different types of metal-cutting saws; provides the complete answer to most metal sawing problems.

ARMSTRONG-BLUM MFG. CO.

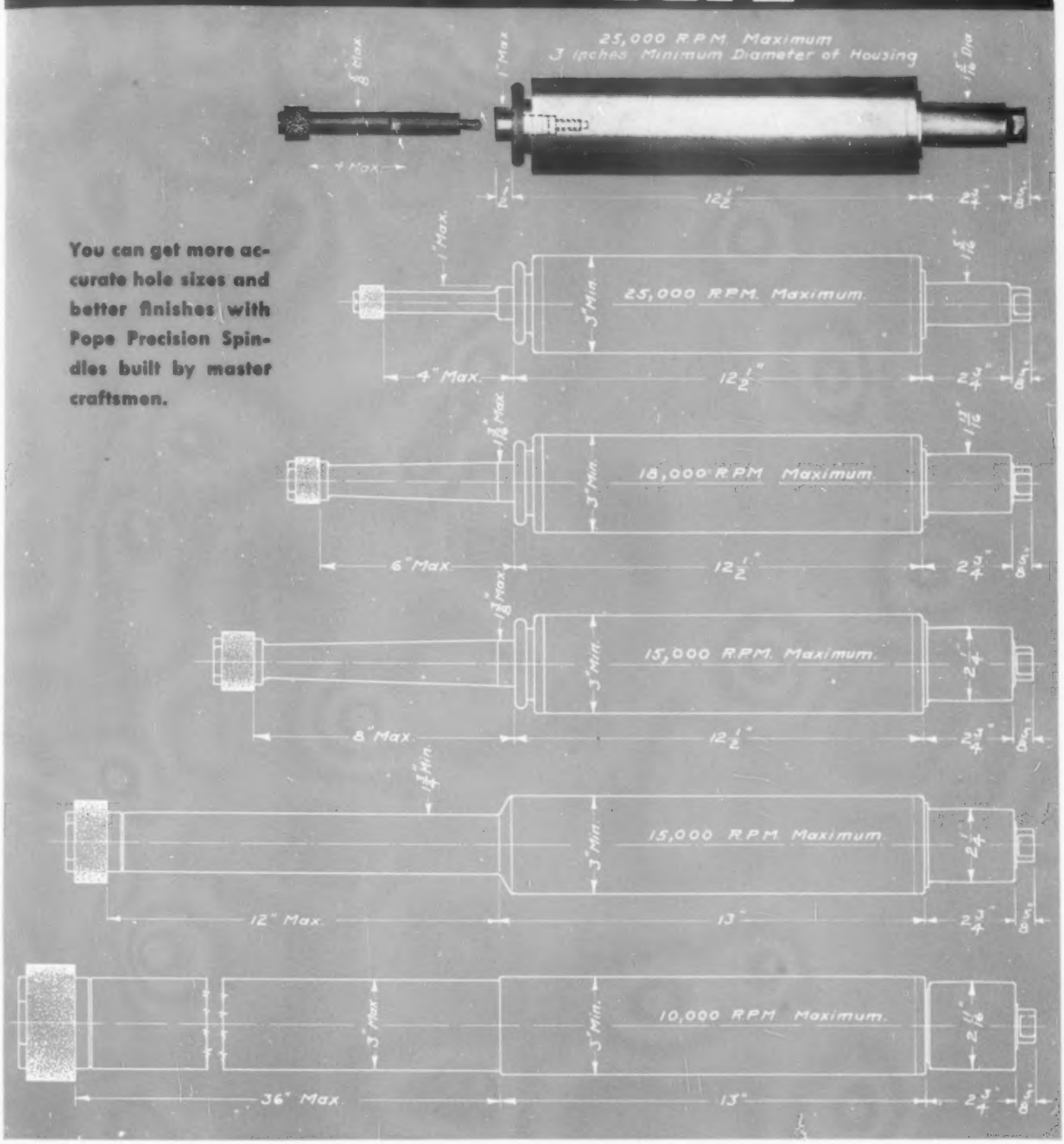
"The Hack Saw People"

5700 Bloomingdale Ave. Chicago 39, U. S. A.
Eastern Sales Office: 225 Lafayette Street, New York 12, N. Y.

MARVEL SAWS

INTERNAL GRINDING SPINDLES *with Sealed-In Lubrication*

DESIGNED AND BUILT BY POPE



You can get more accurate hole sizes and better finishes with Pope Precision Spindles built by master craftsmen.

These internal grinding spindles with sealed-in lubrication are available for prompt delivery in a wide range of dimensions within the limits indicated. Tell us which one you want so we can give you a quotation.

No. 31

POPE MACHINERY CORPORATION

ESTABLISHED 1920

261 RIVER STREET • HAVERHILL, MASSACHUSETTS

BUILDERS OF PRECISION SPINDLES

It Can't Happen

WITH A COVEL No. 15 SURFACE GRINDER!

Work spoilage means lost time, production, and materials. When a part reaches the surface grinding point, it invariably is 90% finished. Complete loss results should the grinding wheel DROP INTO the work. Such an accident *absolutely* cannot happen on a COVEL No. 15 because:

THE SPINDLE REMAINS STATIONARY WHILE THE WORK *MOVES UP* TO THE WHEEL

This simple but vital design feature is only one of many reasons why plant men prefer the COVEL No. 15.

Set-up on the Covel No. 15 (6" x 18") Hand Feed Surface Grinder. Spindle is stationary; table has full 11" vertical travel. Three spindle speeds make it ideal for short production runs where quick set-ups, accurate grinding of odd shaped pieces, mean reduced production costs.

Ask your nearest COVEL Dealer for details . . . or Write, Wire or Telephone for Bulletin TE-36.

GRINDING MACHINERY SINCE 1874

COVEL INDUSTRIAL GRINDERS

COVEL MFG. CO., BENTON HARBOR, MICHIGAN U. S. A.

THIS VERSATILITY

Also Has Many POSTWAR USES

The myriad requirements of war demonstrated the amazing versatility of Vickers Hydraulic Controls. There were so many kinds of jobs to do—jobs which had to be done better than ever before—jobs which had never previously been accomplished.

For example, in this illustration, the plane has Vickers Hydraulic Control for brakes, automatic pilot and cargo door operation. The lift trucks have Vickers Hydraulic Control which lifts and positions the load accurately at the finger-touch of the operator. The graders building air fields use Vickers Hydraulic Power for steering front and rear wheels, raising, lowering or side shifting the blade, and operating the attachments.

These are just a few of the war jobs Vickers Hydraulics have done. Others include the precision movement of heavy battleship turrets—the automatic aiming of anti-aircraft guns—the fast precision positioning of ammunition hoists—the control of bomber gun turrets—and others which, cannot yet be described.

Many of the intricate machine tools that produced the machines that won the war depended for their accuracy, production speed, and ease of operation upon Vickers Hydraulic Controls.

This demonstration of the remarkable versatility of Vickers Hydraulic Controls suggests many new applications to a wide variety of postwar equipment.

VICKERS HYDROMOTIVE EQUIPMENT

VICKERS *Incorporated* • 1416 OAKMAN BLVD • DETROIT 32, MICH.

Application Engineering Offices:

Chicago • Cincinnati • Cleveland • Detroit • Los Angeles • Newark • Philadelphia • Rochester • Rockford • Tulsa • Worcester

There are more than 5000 Standardized Vickers Units that can be used in various combinations to exactly supply Every Hydraulic Power and Control Function

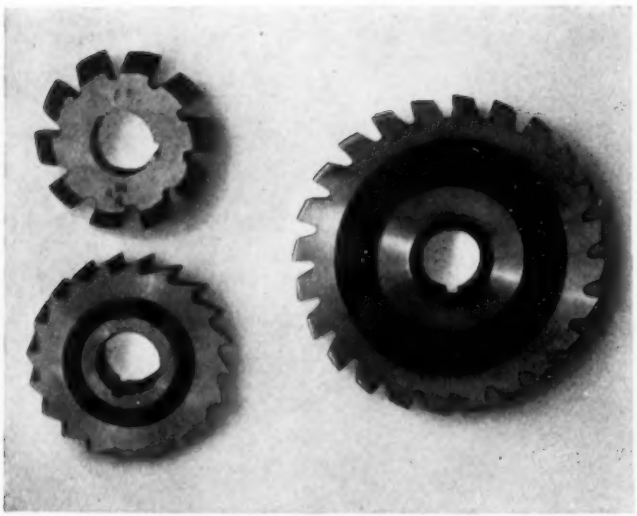
ANY FEED RATE • ANY TRAVERSE RATE • ANY RPM ANY SEQUENCE OF MOTIONS • ANY ACCELERATION OR DECELERATION • ANY THRUST . . . . . .

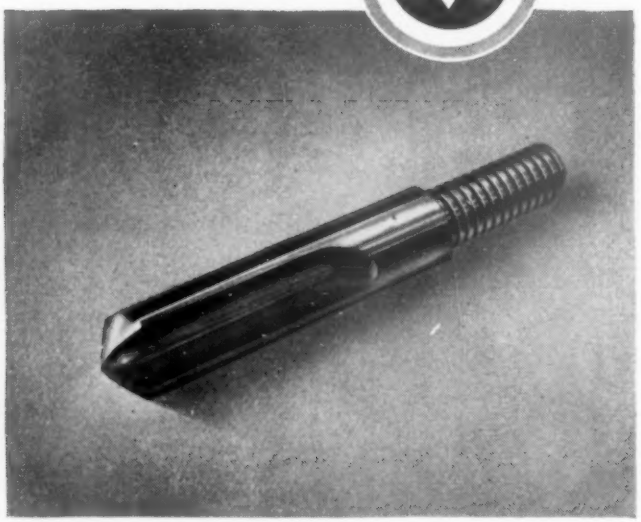
KALEIDOSCOPIC

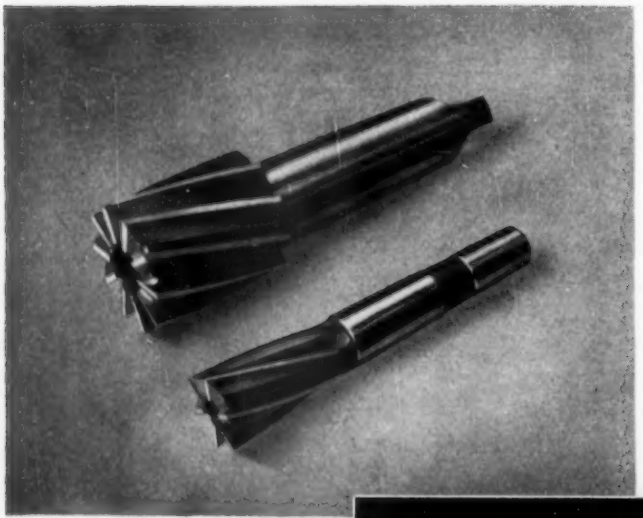
The diversity of form and of application of tool steels is wide. For many years changing demands have been more than met by Midvale's versatile experience. This experience is not static . . . but an always-growing compound of time and knowledge. Accordingly, tool steels of whatever composition for whatever old or new applications, are best made by Midvale hands under Midvale laboratory guidance. Straight Carbon Tool Steels—Alloy Die Steels—Shock Resisting Steels—High Speed Steels—special grades for special purposes—all these are available. And all uphold the Midvale reputation.

THE MIDVALE COMPANY • NICETOWN • PHILADELPHIA

OFFICES: NEW YORK • CHICAGO • PITTSBURGH
WASHINGTON • CLEVELAND • SAN FRANCISCO







One of eight plants to retain original Navy "E"

MIDVALE
Custom Steel Makers to Industry

DELTA
MILWAUKEE
REG. U.S. PAT. OFF.
Machine Tools

Accurate, Low-Cost Tool Grinding --with these

DELTA-MILWAUKEE MACHINES

Delta-Milwaukee Industrial Grinder with Twin-Lite* Safety Shields

Sets new standards of efficiency, safety, and convenience in hundreds of plants.

Twin-Lite Safety Shields help eliminate common eye hazards . . . provide illumination on both sides and face of wheels. Wheel guards meet strict safety regulations of Wisconsin Industrial Commission. Ball bearings are lubricated for life. Tool rests are completely machined, fully adjustable.

Enjoy the efficiency of Delta Grinders in your operations. Bench-type and pedestal-type models. Consult your Delta distributor.

*Trade Mark Reg. U. S. Pat. Off.

Delta-Milwaukee Carbide Tool Grinder

Combined with the Standard Delta Milwaukee Industrial Grinder for hogging down the shank steel, the Delta-Milwaukee Carbide Tool Grinder gives you a perfect combination for sharpening tungsten carbide tools, with a remarkably small investment.

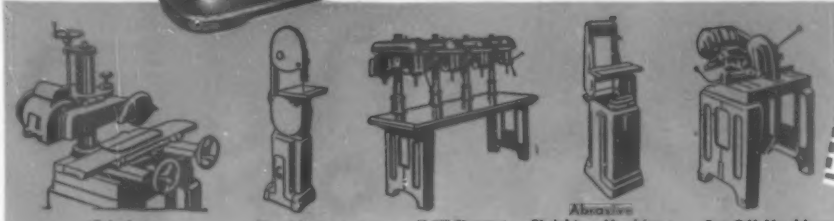
Equipped with one No. 60 grit Silicon-carbide wheel, for preliminary grinding — and one No. 120 Grit Silicon carbide wheel, for producing a perfect cutting edge. Many other worth-while Delta-Milwaukee construction features.

Smooth, vibrationless performance backs up your good judgment in equipping with Delta-Milwaukee Carbide Tool Grinders. Bench and pedestal-type models available.

See your Delta industrial distributor.

Send coupon for free catalog of low-cost Delta-Milwaukee Machine Tools.

M-15



Grinders | Band Saws | Drill Presses | Abrasive Finishing Machines | Cut-Off Machines

[Tear out coupon and mail today!]

THE DELTA MANUFACTURING CO.
611C E. Vienna Ave., Milwaukee 1, Wis.

Send me catalog giving complete details on Delta-Milwaukee's full line of low-cost machine tools.

Name.....
Position.....
Company.....
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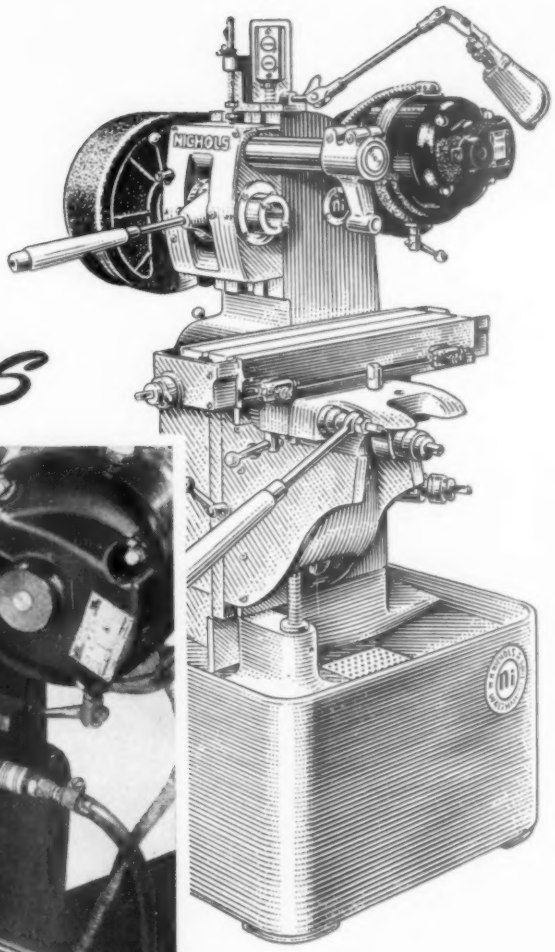
(.....) State.....



Announces

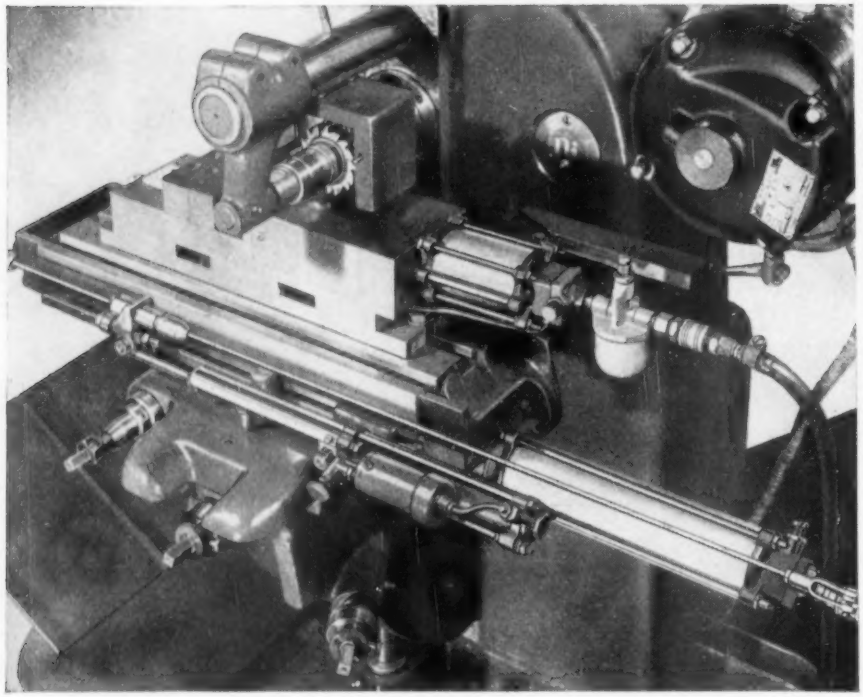


Photo shows Nichols power feed attachment installed. In this case, work is held in an air-operated vise

a *Power* feed attachment for any *Nichols* Miller

Here is a tested and proved power feed attachment that is an added production asset for *any* Nichols Miller. It is designed to reduce the time of the operating cycle and reduce the operator's duties so that often one operator can run two or more machines.

This power feed attachment is designed for fast table advance — maximum proper cutting feed — fast table reverse—automatic shut-off. It is completely automatic except for loading and unloading the work. Rapid traverse and work speeds are easily and quickly changed to suit all classes of jobs within the capacity of the machine.

Basically this attachment is a Bellows air feed unit used in conjunction with a Hydro-Check. Thus a positive, infinitely variable feed is obtained throughout the 9" maximum cutting stroke by using regular shop air lines with 75 to 175 lbs. pressure.

The Nichols power feed attachment can be installed either before or after shipment of the Nichols Miller. *It can be installed quickly on any Nichols Miller ever built.* Write for details.

Send for free Nichols Miller Catalog

THE *Nichols* MILLER

MANUFACTURED BY W. H. NICHOLS & SONS, WALTHAM, MASSACHUSETTS

NATIONAL DISTRIBUTORS: NICHOLS-MORRIS CORP., 46 CHURCH ST., NEW YORK 7, N. Y.

Offsetting Today's Rising Production Costs . . .

BESLY GRINDERS

No. 208-18" Single Besly Grinder

Check These Features:

- Work clamp is spring loaded. When clamp handle is pushed down the operator unloads with one hand and loads with the other.
- Foot treadle enables operator to move work away from grinding wheel for ease and safety in loading and unloading.
- Work is held against grinding wheel by weight feed that pulls table towards grinding wheel to a predetermined position adjusted by micrometer stop screw.
- The work driving fixture spindles are independently operated.

You'll Find This Booklet Helpful

Write for it today on your business letterhead. It's full of valuable data on grinding wheels and abrasives. Besly Titan Steelbacs are easy to use. They increase production.

This "208-18" Besly Grinder answered a very difficult production problem—finishing the O.D. of 2 to 8-blade water pump impellers. Production: 180 to 240 pieces per hour. Finished castings are held to limits of ± .0015.

With a background of more than 50 years accumulated experience, Besly engineers are ready to aid you in developing improved techniques that will help to offset today's rising production costs. They will assist you in selecting the right grinder and the right abrasive.

Why not look in to the possibilities? Write today!

BESLY

BESLY TAPS • BESLY TITAN ABRASIVE WHEELS
BESLY GRINDERS AND ACCESSORIES

CHAS. H. BESLY AND COMPANY, 118-124 N. Clinton St., Chicago 6, Ill., Factory: Beloit, Wis.

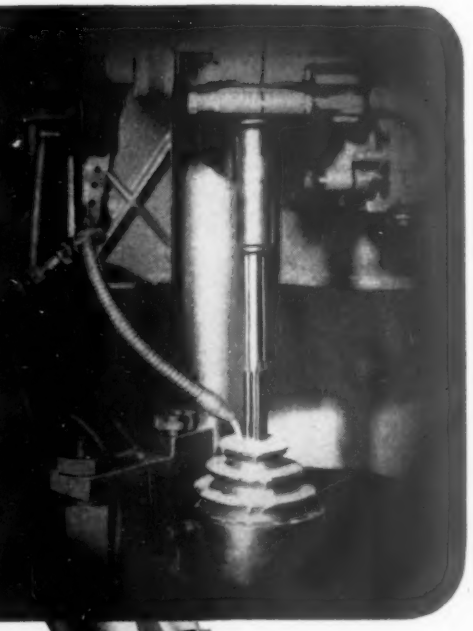
THINK OF IT!

8,000 holes per grind with NEW IMPROVED WENDT-SONIS REAMER

All Standard Sizes Available With Straight or Tapered Shanks

PRODUCTION DATA REPORT

Name:	Delta Manufacturing Company
Address:	Milwaukee, Wisconsin
Tool:	Wendt-Sonis Carbide Reamer. Carbide full length of flute.
Job:	Reaming Pulley Wheel Hole. S.A.E. 6150 steel. Super finish required.
Speed:	935 RPM.
Feed:	.006" feed per revolution.
Results:	Averaged 8000 holes per grind—holds size—super finish.



First again

WENDT-SONIS REAMERS with FULL LENGTH CARBIDE FLUTES

Here is a reamer that will reduce rejects, speed up production and save on tool costs.

Wendt-Sonis *full length carbide flutes* eliminate "wobbling" ordinarily caused by wear on steel flutes. These new *full length carbide flutes* have greater wear resistance than those with carbide tips only. They prevent chips from marring the hole on horizontal reaming jobs. Maximum flute bearing surface in bushing assures perfect hole alignment and long life. These reamers can be used on angle reaming jobs without guide bushings. Now AVAILABLE in all standard sizes. WENDT-SONIS COMPANY, HANNIBAL, MISSOURI. BRANCH WAREHOUSE: LONG BEACH, CALIFORNIA.

WENDT W CARBIDE S SONIS

CARBIDE TIPPED CUTTING TOOLS

BORING TOOLS • CENTERS • COUNTERBORES • SPOTFACERS • CUT-OFF TOOLS • DRILLS • END MILLS
FLY CUTTERS • TOOL BITS • MILLING CUTTERS • REAMERS • ROLLER TURNING TOOLS • SPECIAL BITS

Super Smooth

FINISH FOR INTRICATE PLASTIC MOULDS

No. 8—A light weight tool, but precision built throughout. Speed: 18,000 r.p.m. Weight: 2 lbs., 6 oz. 1/20 h.p.

High Speed, Perfectly Balanced Dumore Hand Grinders Assure Extreme Accuracy on Finishing Operations

To give thermo plastic products their highly polished surfaces, the moulds in which they are made must be super smooth. First, machine marks and surplus metal must be removed from the intricate steel moulds, and then the required size and surface finish provided by highly skillful hand grinding and polishing.

On these operations, The Chicago Molded Products Co., which produces thousands of plastic products weekly, has used Dumore No. 8 Hand Grinders with great success. For the light weight and perfect balance of these Dumores, their high speed and smooth power, enable the operator to remove material with extreme accuracy . . . to maneuver a variety of tiny mounted wheels and brushes in close quarters with surprising ease.

In countless other ways Dumore Hand Grinders are demonstrating daily their ability to take the short-cut ways to greater production. Find out how they can help *you*—write for Dumore's new grinding handbook, "Here's How." The Dumore Company, Tool Division, Dept. TC43, Racine, Wisconsin. (Eastern Sales and Service Branch, 13 East 40th Street, New York 16, N. Y.)

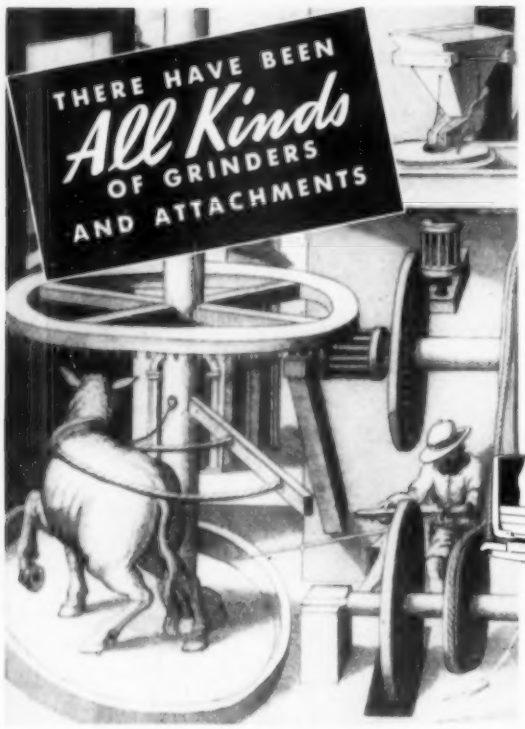
No. 10—A tool with *double* the power of the average grinder. Speed: 22,000 r.p.m. Weight: 2 lbs., 15 oz. 1/10 h.p.

No. 9—Powerful, smooth handling, yet gets into tight quarters easily. Speed: 15,500 r. p. m. Weight: 7½ lbs. ¼ h. p.

DUMORE

PRECISION AND HAND GRINDERS

Sold by Authorized Industrial Distributors in All Principal Cities

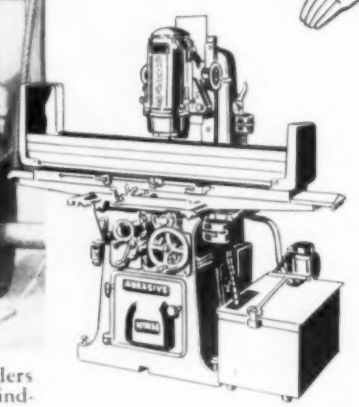


American ingenuity has brought modern grinders a long way from this ancient one horsepower grinding machine with its cumbersome gearing, rope belting and strange attachments. The bearded operator, without leaving his work, increased the r.p.m. of the grinding wheel by a sharp prod on the unlucky horse. *Illustration from Bettmann Archive*

ABRASIVE M-34

VERTICAL SPINDLE SURFACE GRINDER WITH WET GRINDING ATTACHMENT

Compact, powerful and accurate, the Abrasive M-34 fully meets today's requirements for a precise production grinder. The motorized spindle eliminates belt drive and delivers maximum power at the cutting point . . . takes heavy cuts with excellent finish. Massive one-piece bed casting minimizes vibration. Table feeds are automatic, with hydraulic shock absorber to cushion table reversal.



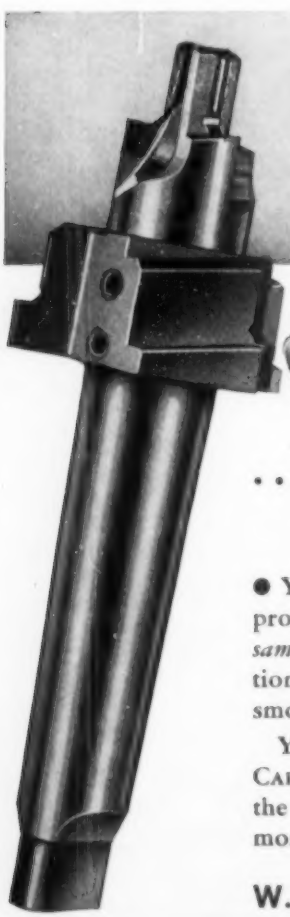
Fully automatic No. M-34 Vertical Spindle Surface Grinder. Capacity: 24" longitudinal, 8" transverse and 12" vertical.

Ask for descriptive bulletin.

ABRASIVE MACHINE TOOL CO.
East Providence 14, Rhode Island
Dealers in Principal Cities

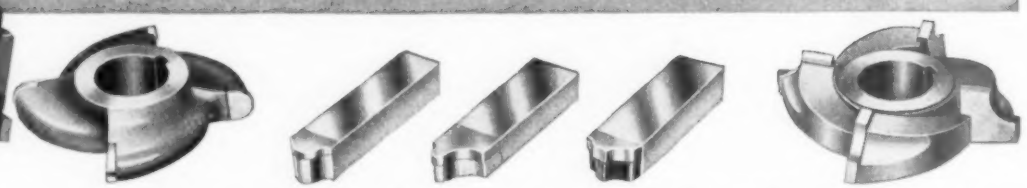
Write us for information on ABRASIVE Machines on the Government Machine Tool Surplus List . . . just send the machine serial number. Attachments, accessories and repair parts are also available.

ABRASIVE
ACCURACY BOOSTS PRODUCTION



Peacetime Production

MEANS BACK TO COMPETITION!



. . . and here are the tools that will give you the "edge" *on competition* . . .

● Yes, peacetime production will have its problems, even as war production. Not the *same* problems, but just as tough. Competition will require tools that cut clean—fast—smooth—accurately.

You can depend upon MEYERS GENERATED CARBIDE-TIPPED FORM TOOLS to give you the "edge" on competition, by giving you more pieces per hour—more pieces between grinds—and a much smoother finish. On actual production runs, MEYERS GENERATED CARBIDE-TIPPED TOOLS have boosted production by more than 500%!

Send us your prints for quotation.

MEYERS GENERATED
***Carbide Tipped* FORM TOOLS**

W. F. MEYERS COMPANY, INC. · *1024 14th St., Bedford, Ind.*

In the Sperry Rail Welders, Oilgear grips rail ends, positions, aligns, and holds them with increasing pressure while establishing welding contact, releases welded rails, moves into position for next cycle.

Do you need tremendous power or little power . . . exquisitely applied? *Then call in Oilgear*

Did you know that standard railroad rails can be welded together in homogeneous units thousands of feet long? That they can be welded on the right-of-way, the increasing length stretching out behind on flat cars and easily negotiating 15 degree reverse curves in the track? That it's all done automatically, eliminating the human element? And that Oilgear Fluid Power furnishes not only the tremendous power to grip the massive load but the tremendous precision that matches perfectly the faces-to-be-welded with increasing pressure which climaxes in the final weld?

You may need power that can be applied with precise control . . . power that can be increased or decreased smoothly and instantly . . . infinitely variable speed . . . automatic work cycles . . . extremely accurate control of position or speed of a reciprocating member . . . constant horsepower output through all or a part of a speed range . . . or any of scores of other functions. Whatever your straightline or rotary power transmission problem you will find a better solution in Oilgear Fluid Power. Write now without obligation. THE OILGEAR COMPANY, 1308 W. Bruce St., Milwaukee 4, Wisconsin.

Oilgear Fluid Power

ARE YOU TRYING TO:

1. Apply large forces through long . . . or short . . . strokes at variable speeds? **2.** Obtain automatic work cycles, variable speeds in either direction . . . with or without preset time dwell? **3.** Apply large forces through continuous or intermittent reciprocating cycles at constant or variable velocities? **4.** Obtain extremely accurate control of either position or speed of a reciprocating member? **5.** Apply accurately variable pressure either static or in motion? **6.** Closely synchronize various motions, operations or functions? **7.** Apply light . . . or heavy . . . forces at extremely high velocities through either long or short distances of travel? **8.** Obtain continuous automatic reversing drives at constant R.P.M. or over a wide range of speed variation? **9.** Obtain accurate remote control of speed and direction of rotation, rates of acceleration and/or deceleration? **10.** Obtain constant horsepower output through all or part of a speed range? **11.** Obtain automatic torque control? **12.** Obtain accurately matched speed of various rotating elements? **13.** Obtain constant speed output from a variable speed input? **14.** Obtain full preset automatic control, elimination of problems of shock, vibration, etc.?

You Need Oilgear!

PRECISION THAT LASTS

WEBBER

Heavy Duty

GAGE BLOCKS

● The reason that the life expectancy is longer and original accuracy maintained for such long periods is due to the inherent quality built into Webber Gage Blocks.

This comes from selection of the correct steel—proper heat treatment—skillful finishing—and "know how" gained from years of painstaking experience in the exclusive manufacture of Webber Gage Blocks.

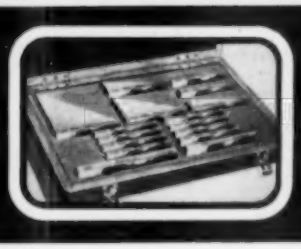
The Heavy Duty Gages illustrated are practical precision tools for use in shop—tool room—and inspection operations. They can easily and quickly be built up into height gages—inside or outside calipers—dividers for layout work.

For gage blocks that adapt themselves to shop temperatures—that maintain their original precision over long periods—that provide greater flexibility in making precision measurements—specify Webber Heavy Duty Gage Blocks.

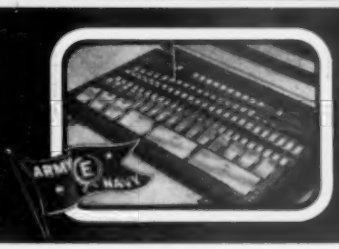
Prices:

Set No. 84-A	$350.00	Set No. 43-A	$185.00
Set No. 84-B	$235.00	Set No. 43-B	$150.00

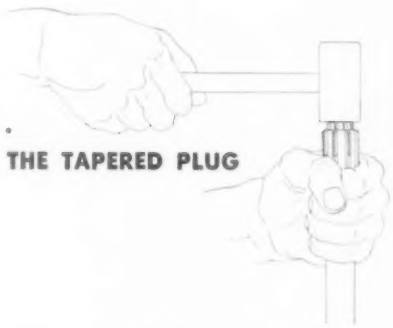
Set No. 38-A (Thin Blocks) $195.00
Set No. 38-B (Thin Blocks) $155.00
Set No. 24-HD (Heavy Duty) $385.00
Capacity up to 24 inches
Set No. 36-HD (Heavy Duty) $450.00
Capacity up to 36 inches



Webber
GAGE COMPANY
12908 TRISKETT RD. • CLEVELAND 11, OHIO

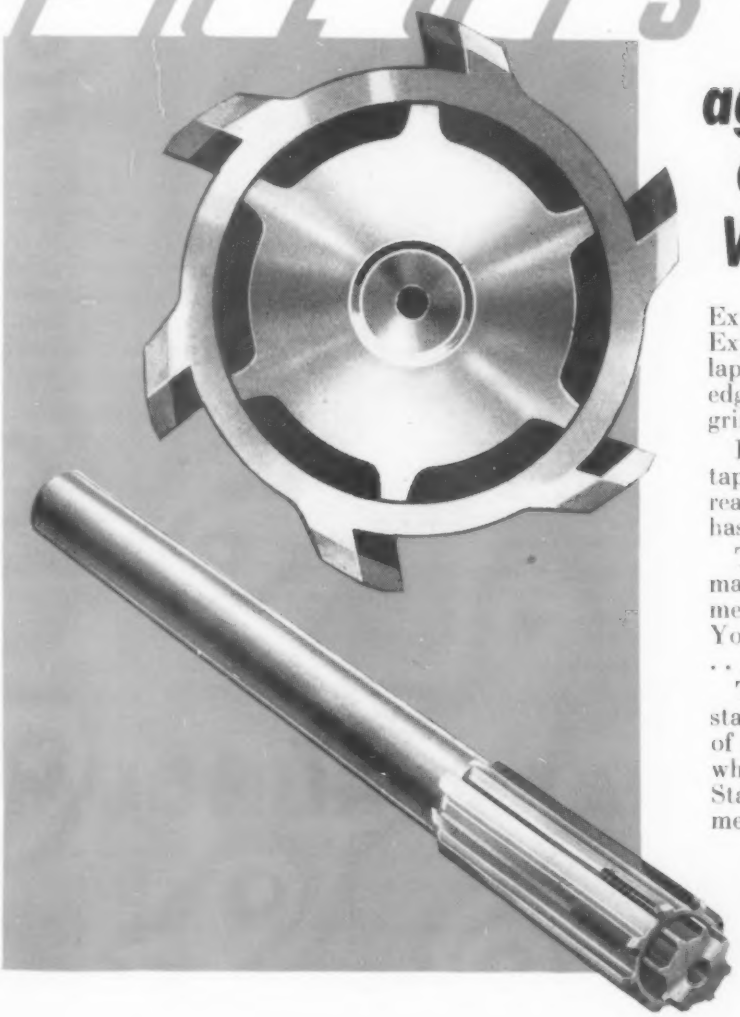


Staples
CARBOLOY-TIPPED EXPANSION REAMERS



TO EXPAND . . .
JUST DRIVE IN THE TAPERED PLUG

PRECISION . . .



again and again and again— WITHOUT REGRINDING

Expand the solid body of a Staples *exclusive* Expansion Reamer. Tilt back the diamond-lapped Carboloy Cemented Carbide cutting edges. Do this again and again, without regrinding . . . and get precision every time.

Instead of regrinding, simply drive in the tapered plug and increase the diameter of the reamer to compensate for the amount that has worn.

The patented Staples Expansion Reamer is made with a one-piece body—not split. This means rigidity—and rigidity means precision. Your results are finer finish, longer tool life . . . real economy.

This exceptional tool met the exacting standards of wartime construction. It is one of a line of quality circular cutting tools used wherever very close tolerances are held. Standard tools in stock for immediate shipment. Special tools designed.

THE STAPLES TOOL COMPANY
Formerly Staples Tool & Engineering Company
CINCINNATI 25, OHIO

Staples CARBOLOY-TIPPED CIRCULAR CUTTING TOOLS

REAMERS • CORE DRILLS • SPOT FACERS • COUNTERBORES • END MILLS • SHELL END MILLS • ALSO A COMPLETE LINE OF CIRCULAR SPECIAL TOOLS

Who really knows what bond is best?

Your experience tells you this is a tough one to answer. You've seen what correct bond selection means in faster, better grinding at less cost. You know the importance of the right bond in terms of maximum cut with minimum pressure and lowest wheel loss.

You have probably seen one of your own shop experts worried with what seemed a logical choice. For, there's plenty of room for error in evaluating the many variable factors involved.

For instance, the speed of the grinder, tolerance limits, or production schedules are but a few of many factors to be considered. Yet, neglecting one...even partially...will upset the calculated performance of the wheel you choose.

To help you make the best choice of wheels, CARBORUNDUM has organized a system of checks and balances. It offers you a practical service...service easy to use...service depended on by many successful concerns.

CARBORUNDUM salesmen and our distributor's representatives are your contact with this service. They are familiar with your needs. They are informed on latest abrasive developments. Supporting them in the field are our Abrasive Engineers...qualified to solve tough grinding problems. And here, in the modern laboratories of CARBORUNDUM, are scientists and technicians probing grinding practices in the light of abrasive development. As a result, they usually come up with the most direct solution to difficult grinding problems.

There is no better way to find out what bond is really best, or what wheel to use, than to depend on this organized service. It is a smooth working combination of knowledge and experience. Call in CARBORUNDUM. There is no surer means of making certain you are getting the best. The Carborundum Company, Niagara Falls, New York.

A good rule for good grinding... **CALL IN**

CARBORUNDUM

TRADE | MARK

BONDED ABRASIVES

WHEELS
Silicon Carbide
Aluminum Oxide
Diamond
Cylinder Hones
Sticks, Stones & Rubs
Specialties

COATED ABRASIVES

Paper, Cloth and Combination
Sheets, Rolls, Discs

ABRASIVE GRAINS AND COMPOUNDS

for:
Polishing
Lapping
Pressure Blasting
Finishing

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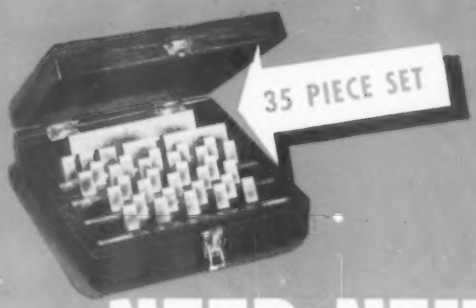


Fonda Lifetime *Carbide* Gage Blocks

NEED NEVER BE REPLACED ...OR RECALIBRATED!

FONDA offers industry a *complete* set of gage blocks in tungsten carbide. Blocks with more than 100 times the abrasion-resistance of hardest high-carbon steel gage blocks, and fully 98 times that of chrome-plated!

The normal four months' wear of steel blocks in constant use scarcely would appear in tungsten-carbide blocks after 33 YEARS of service.

Further, the inherent stability of tungsten carbide prevents growth or shrinkage. FONDA tungsten-carbide blocks therefore provide a lifetime of fine-precision accuracy. *Holding* a surface finish of .2 to .4 r.m.s. or better . . . accuracy of size, flatness and parallelism equalling or exceeding the Bureau of Standards' requirements!

No worrying—ever—about gage block wear impairing the accuracy of your measurements! None of the expense of frequent work rejects! No more of that annoyance and expense of continuously recalibrating and replacing worn gage blocks!

Yes; FONDA Tungsten-Carbide blocks upset all former conceptions of gage block use. Wringing is amazingly improved and facilitated. No corrosion through moisture or fingermarks. And your shop precision standards can be maintained consistently at a new high level.

Sizes in the 82-piece set range from .050" to 4.000"—with 480,000 dimension combinations possible. In the 35-piece set, sizes range from .1001" to 4.000"—with over 80,000 combinations.

For the whole remarkable story, write to Dept. E

FONDA GAGE COMPANY

STAMFORD, CONNECTICUT, U. S. A.

Agents in all principal cities throughout the world

FONDA *Gage Blocks*

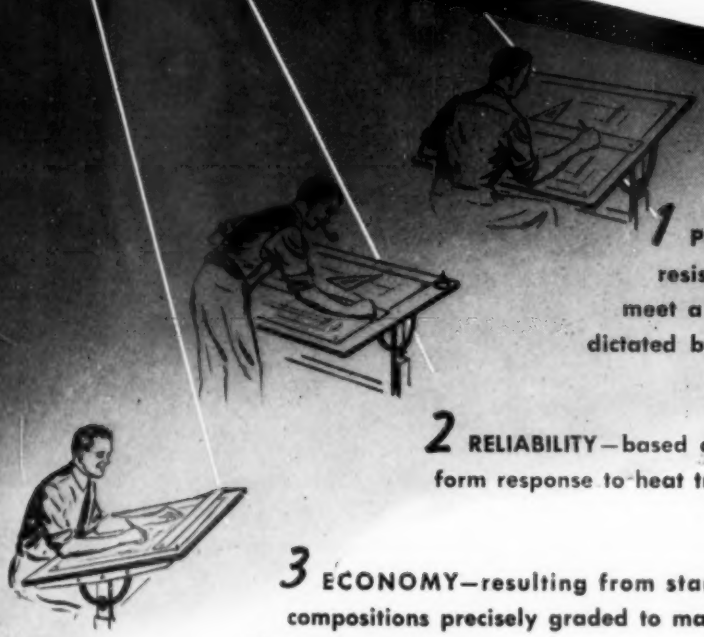
CARBIDE OR STEEL (PATENTS PENDING)

PASSED HIGHEST TESTS DEVISED BY THE NATIONAL BUREAU OF STANDARDS

MANUFACTURERS OF FINE-PRECISION GAGES AND GAGE BLOCKS

Triple reasons for specifying...

TRIPLE ALLOY STEELS *containing* NICKEL



1 PERFORMANCE—Strength and toughness, resistance to wear, fatigue or shock to meet a wide range of requirements, as dictated by design.

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3 ECONOMY—resulting from standard compositions precisely graded to match the engineers' needs.

Experience shows that triple-alloy steels containing Nickel are solving some mighty big problems in many industrial fields. They have established outstanding service records in some of the most exacting applications. The many standard compositions available make it possible to select *accurately*, and with economy, triple-alloy steels to fulfill the requirements of a great variety of applications.

We invite inquiries regarding the selection and uses of triple-alloy steels, containing Nickel.

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NATIONAL Service Engineers have had years of experience in dealing with all types of problems concerning metal cutting tools and their uses. No charge or obligation. Just call your local NATIONAL distributor.

Call Your **DISTRIBUTOR!**

Leading distributors in every section of the country have complete stocks of National Cutting Tools. Call your Mill Supply Distributor for National Cutting Tools or any staple industrial product.

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REAMERS, HOBS
MILLING CUTTERS
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SPECIAL TOOLS
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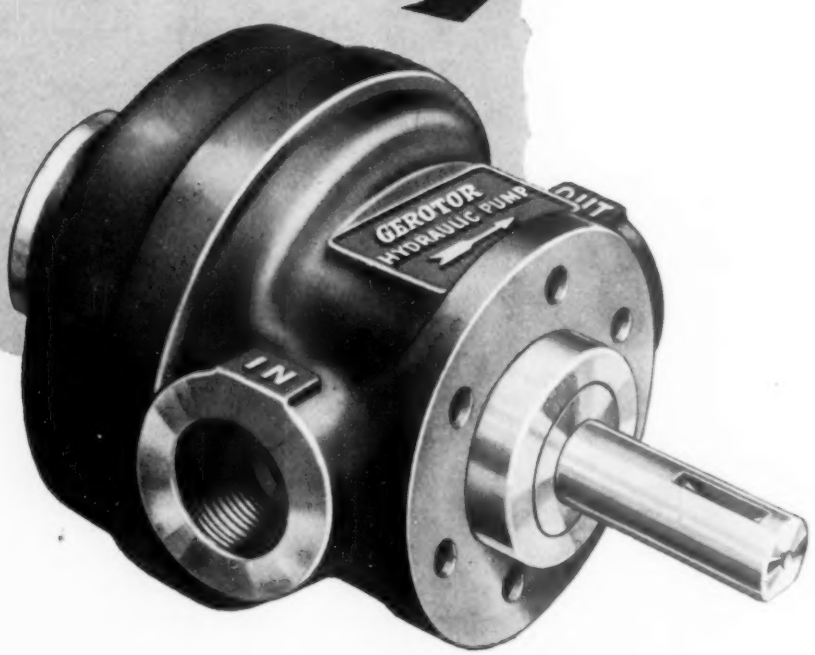
HYDRAULIC PUMPS

are "working partners" in many important jobs

Straight across the country, in many fields of industry, you'll find Gerotor Hydraulic Pumps doing an outstanding job as the working partner of important industrial equipment. Specified as standard equipment on these industrial machines, Gerotor transforms an intricate pump problem into a dependable pump performance.

If you have a pump problem that is holding up your production, consider Gerotor's low cost operation. And let Gerotor's staff of engineers show you how these famous pumps can do a better job for you.



GEROTOR MAY CORP., BALTIMORE 3, MD., Plants at Logansport, Ind., Baltimore, Md.

LATROBE

announces a major advance in the making of HIGH SPEED STEELS

Important new process sets new standards of quality!

DESEGATIZED is a new word that has been coined by the Latrobe Electric Steel Company to describe its *new process* high speed steel. It means that the steel is free from the usual carbide segregation, heretofore believed to be a characteristic inherent in high speed steel.

Perfection is difficult in any field. However, the DESEGATIZING process is the greatest step along the road to perfection in high speed steels. The even distribution of carbides throughout every cross section produces a steel remarkably free from segregation. Thus, DESEGATIZED High Speed Steel is far superior to existing standards of quality in the industry.

Be sure to write for this booklet—just off the press, describing this exclusive Latrobe development.

DESEGATIZED
HIGH SPEED STEELS

S-2

Latrobe ELECTRIC STEEL COMPANY

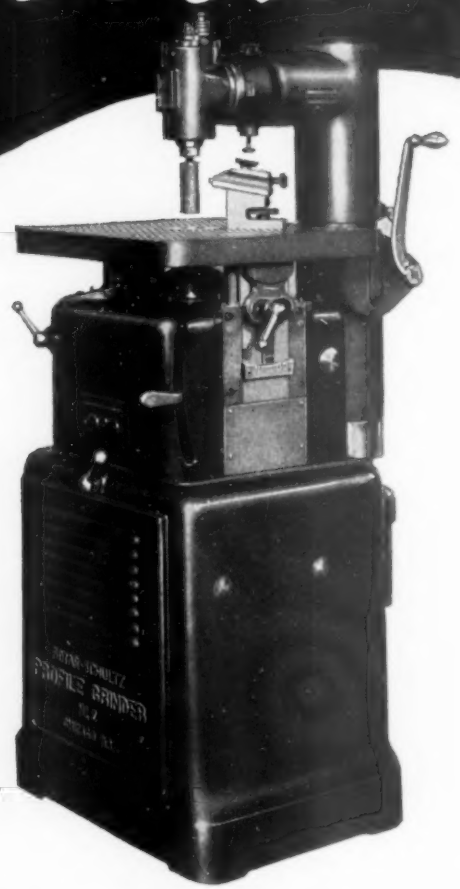
MAIN OFFICES *and* PLANT •• LATROBE • PENNSYLVANIA

LESCO

Cut TOOL AND DIE Costs!

WITH

BOYAR-SCHULTZ PROFILE GRINDERS



BOYAR-SCHULTZ PROFILE GRINDERS

NO. 1 BENCH MODEL

A fast operating, precision Machine Tool for saving time in grinding difficult contours, and irregular shapes and profiles. In production as well as in tool and die work, it performs quickly, much of the tedious work formerly requiring hours of hand time.

Spindle speed of 20,000 R.P.M. with vertical oscillation assures rapid stock removal, even with wheels of small diameter. Accommodates wheels ⅛" to 1" diameter.

Visit Us, at the
A.S.T.E. SHOW
CLEVELAND, APRIL 8-12
BOOTH No. 711

NO. 2 DUAL SPINDLE FLOOR MODEL

A precision Machine Tool, designed for larger and heavier work, grinding contours and irregular shapes. This dual spindle model is really two machines in one. Spindles are independently powered and operate at 10,000 R.P.M. with vertical oscillations. Stock removal is rapid with wheels as small as ½" diameter. Accommodates wheels ½" to 3" diameter.

NO. 2 SINGLE SPINDLE FLOOR MODEL

Exactly the same as the Dual Spindle Model except without the upper spindle, which may be added at any time if desired. A favorite Machine Tool in Tool and Die Shops.

WRITE FOR LITERATURE

BOYAR-SCHULTZ CORPORATION

2104 WALNUT STREET • CHICAGO 12, ILLINOIS

UNLIMITED SPEED SELECTION AT THIS WIRE DRAW BENCH!

All operating functions, including adjustable-speeds are provided from plant's A-c. circuit on this Waterbury-Farrel Wire Draw Bench by a 5 Hp. Reliance V•S Drive.

In the North Chicago plant of the Fansteel Metallurgical Corporation there is a draw bench which processes wire for many unusual purposes from such "story book" metals as tantalum, tungsten and molybdenum. And, because of the need for widely varied speeds under constant and absolute control, the Reliance V•S Drive has proved a "natural" for these delicate operations.

With V•S—an *all-electric, adjustable-speed drive operating from A-c. circuits*—unlimited speed variation with absolutely smooth acceleration and deceleration and automatic maintenance of proper tension are available. Automatic reversal can be provided at any desired point. Starting, stopping and speed changes are controlled from either nearby or remote stations.

Write for Bulletin 311, or call the nearest Reliance office for information about Reliance V•S Drive which may suggest how you can use it profitably in your own production operations, or in designing new production machinery.

See the Operating Exhibit of the Reliance V•S Drive at the American Society of Tool Engineers Exposition • Cleveland, April 8-12

RELIANCE ELECTRIC & ENGINEERING CO.

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"MOTOR-DRIVE IS MORE THAN POWER"

What is the Industrial Significance

OF THE AUTOMATIC CYCLED MACHINE?

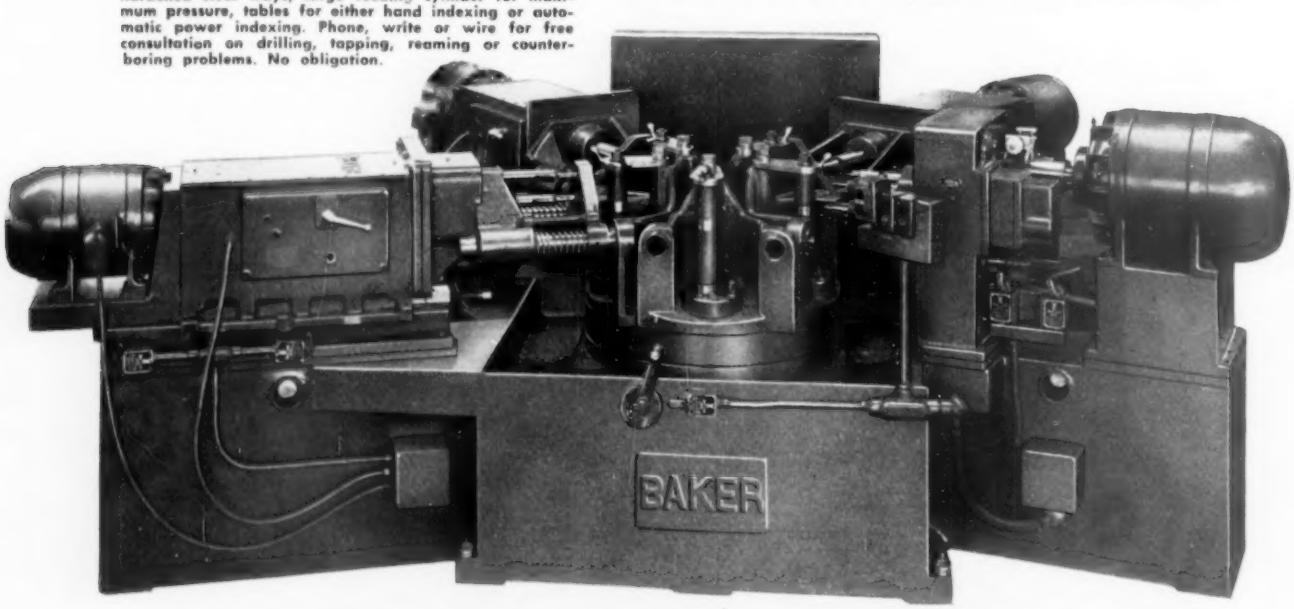
Baker Brothers, Inc., specializes in highly automatic, highly productive machines that increase the worker's output. They lower unit cost and broaden the potential market for the product, helping the company grow. In so doing, increased productivity creates jobs, raising the country by the surest and most practical means toward full employment.

Our highly productive machines do not eliminate the human element: They give men the advantage of a greater production capacity. They eliminate unnecessary demands upon strength. They cut down fatigue. They assure accurate production and go far toward eliminating waste.

Baker Brothers believes that tool engineering has a great responsibility today because its work is fundamental to the operation of modern industry. Baker Brothers builds highly productive, automatic-cycled machines because *they are necessary* to you, the alert manufacturer, and to the system of free economy upon which our nation has grown great.

Multi-operation machine 7½AA14 is a self-contained, hydraulic feed unit with automatic cycling and remarkable flexibility. On each cycle one transmission case is drilled, bored, faced and tapped. Features include hardened steel ways, large feeding cylinder for maximum pressure, tables for either hand indexing or automatic power indexing. Phone, write or wire for free consultation on drilling, tapping, reaming or counterboring problems. No obligation.

◀ ***Baker Multi-operation Machine***



BAKER BROS., INC.

Toledo 10, Ohio

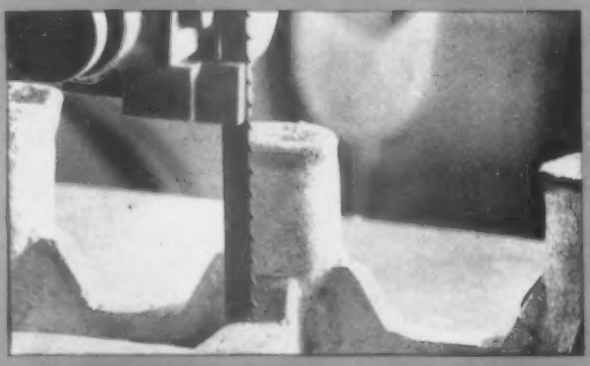
SIMONDS gives you the right Band Saw to deliver Top Output and Economy in cutting any type of Metal or Plastic

1. REGULAR HARD EDGE BAND SAWS

Simonds Steel Mills produce a special tough alloy steel for these saws. Teeth are sharp, perfectly milled, and set even on both sides of blade, to give clean, easy cutting and long saw life. And joints are welded for equal strength with rest of blade.

2. SKIP-TOOTH BAND SAWS

Here's the extra gullet-capacity for large chips from aluminum, magnesium, plastics and wood. These saws stay sharp so long that it's economical to replace them and save resharpening. They have the same hardened tooth-edge as the Regular Hard Edge Saws. Made in widths from ¼" to 1" Tooth-spacings: 2, 3, 4, and 6 per inch.



3. SPRING TEMPER BAND SAWS

Especially successful in sawing thin sheet aluminum, magnesium, and steel . . . also brass, light structural shapes, plastics, fibre, non-ferrous tubing and similar materials. These blades cut for exceptionally long periods without dulled teeth . . . and then they are quickly reset and filed and put back on the machine.

Consult your Industrial Supply Distributor about the best type and specification of Simonds Band Saw for *your* work. Or write the nearest Simonds office.

SIMONDS
SAW AND STEEL CO.
FITCHBURG, MASS.

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1350 Columbia Road, Boston 27, Mass.; 127 S. Green St., Chicago 7, Ill.; 416 W. Eighth St., Los Angeles 14, Calif.; 228 First St., San Francisco 5, Calif.; 311 S. W. First Ave., Portland 4, Ore.; 31 W. Trent Ave., Spokane 8, Wash.; *Canadian Factory:* 595 St. Remi St., Montreal 30, Que.

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KELLER POWER HACK SAWS

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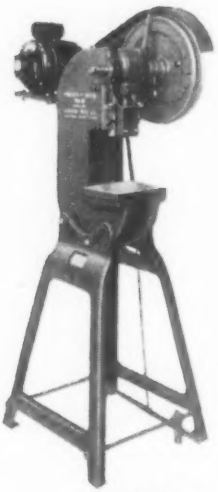
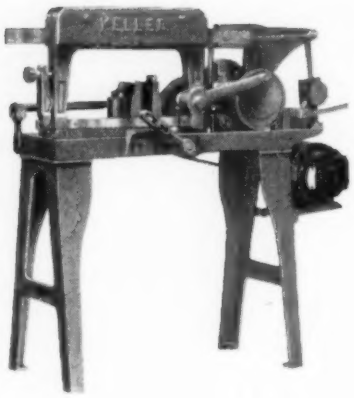
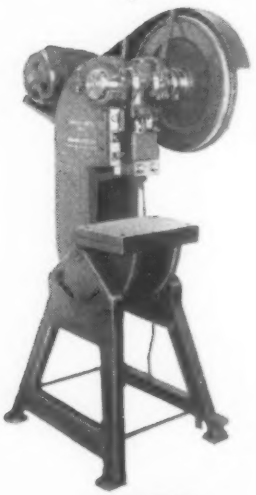
NEW ERA EXPOSITION

CLEVELAND, OHIO

April 8—12







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Designed to handle any class of work within the limits of eight inch stroke shapers. Precision built for precision work and will give years of satisfactory service.

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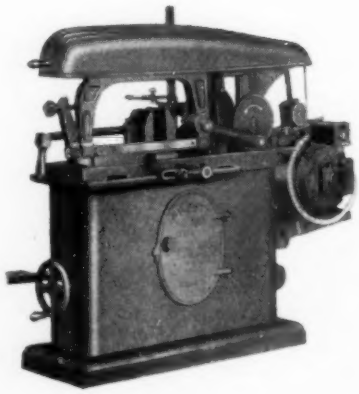
Now built in three sizes: 5 ton, 10 ton and 18 ton, open back inclinable models with extra large die space clearances, latest design, simple and rugged construction, durable and dependable.



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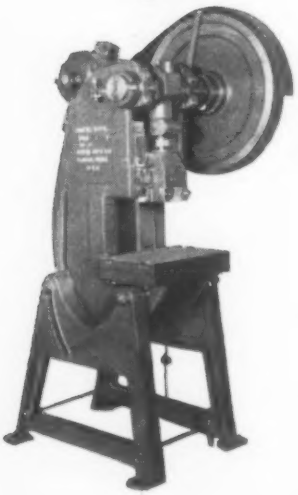
Built in several models from small bench type to 6¾" x 6¾" capacity Hy-Duty model. Cut your cutting costs with Keller Saws.



FOR COMPLETE INFORMATION

See your local dealer or write direct to us.

Sales Service Machine Tool Co.

2426 UNIVERSITY AVE. ST. PAUL 4, MINN.

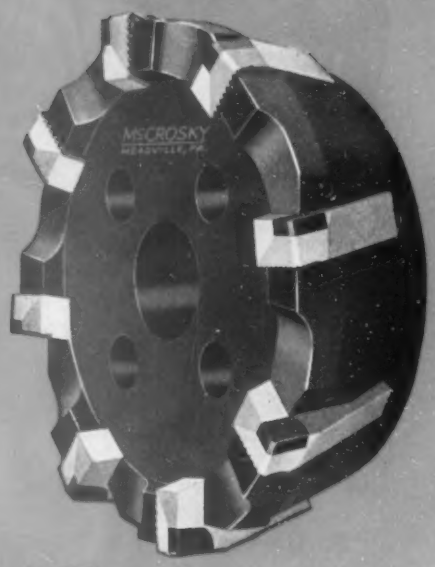
McCROSKY

Multi-Duty Carbide Tipped

Jack-Lock

TRADE MARK REG. U.S. PAT. OFF.

MILLING CUTTERS



SEE THESE STANDARD "SHIP-FROM-STOCK" CUTTERS AT BOOTH 829 – A.S.T.E. SHOW

● McCROSKY LEADS AGAIN! – this time with a new line of Multi-Duty Carbide Milling Cutters. Unlike the special purpose carbide cutters, designed and built for one set of work conditions only, these new Multi-Duty cutters are general purpose tools,– they can be used on one job after another.

The number of blades, and the rake and spiral at which the blades are mounted, permits the use of Multi-Duty cutters on an extremely wide variety of medium duty work. And the alloy steel bodies, carefully heat-treated in our modern salt bath furnaces, provide the ruggedness needed for service on the super-powered machines that have recently been developed.

Multi-Duty cutters are furnished in two styles,–one for milling cast iron and non-ferrous metals,– the other for steel. Both feature the Jack-Lock blade locking device,– conceived and developed by McCrosky engineers,– that gives McCrosky inserted blade tools the rigidity of solid tools on the job,– yet permits quick release of the blades, and easy and accurate adjustment so that a minimum amount of stock is lost in regrinding. Bulletin No. 461 – just released – gives full details. Send for a copy.

COST CUTTING TOOLS

McCROSKY TOOL CORPORATION

MEADVILLE, PA.

Designers and Manufacturers of

Jack-Lock Milling Cutters
Block Type Boring Bars
Wizard Chucks and Collets
Super Adjustable Reamers
Turret Tool Posts
Special Multiple Duty Tools

An All-Purpose

SURFACE GRINDER

. . . In Every Way

The
HANCHETT NO.36
VERTICAL SPINDLE ROTARY TABLE

Represented in Latin America by Machine Affiliates, Inc.

Use the No. 36 FOR GRINDING

- Diesel Engine Parts
- Rough Castings
- Dies and Jigs
- Small Cutting Tools
- Many Similar Parts

Check these Features

One-Piece cast semi-steel column assures *Rigidity* for the most precise grinding operations. Patented Head Design allows grinding head to be tilted in *Any Direction*.

Table speeds are *Variable*, ranging from 6 to 36 R.P.M. Capacity — Work up to 40" diameter and 14" high. *Automatic Feeds* and stops located on Push Button control panel making one centralized unit.

HANCHETT ENGINEERING SERVICE

Hanchett Engineers will be glad to study drawings and requirements, and make recommendations on the proper method and machine for your job, with no obligations on your part.

And remember — since Hanchett makes *all* types of surface, face, and disc grinders, you are assured of unbiased advice on your grinding problems. Feel free to consult the experts of the industry.

For detailed information and production figures on the Hanchett No. 36 Rotary Surface Grinder, send for your copy of Bulletin 144-1TC. You'll see why the Hanchett No. 36 is considered standard equipment in both large and small shops in all industries.

HANCHETT GRINDERS — BIG RAPIDS, MICHIGAN

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the KNOWHOW WHY and WHEREFORE

of DRILLS and DRILLING PRACTICE

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NATCO'S "DRILLS AND DRILLING PRACTICE" has been prepared from up-to-the-minute knowledge obtained through the solution of drilling problems worked out through applications in the field.

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The 51-pages of illustrations and information contained in this booklet deal with the proper types of drills, drill grinds, coolants, and feeds and speeds for ferrous and non-ferrous metals, wood, plastics, rubber and various compounds.

The sole purpose of presenting this publication is to contribute to the drilling art as practiced in everyday manufacturing.

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National Automatic Tool Company, Inc., Richmond, Ind.

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INVESTIGATE NATCO METHODS FOR THE LOWEST POSSIBLE HOLE COSTS!

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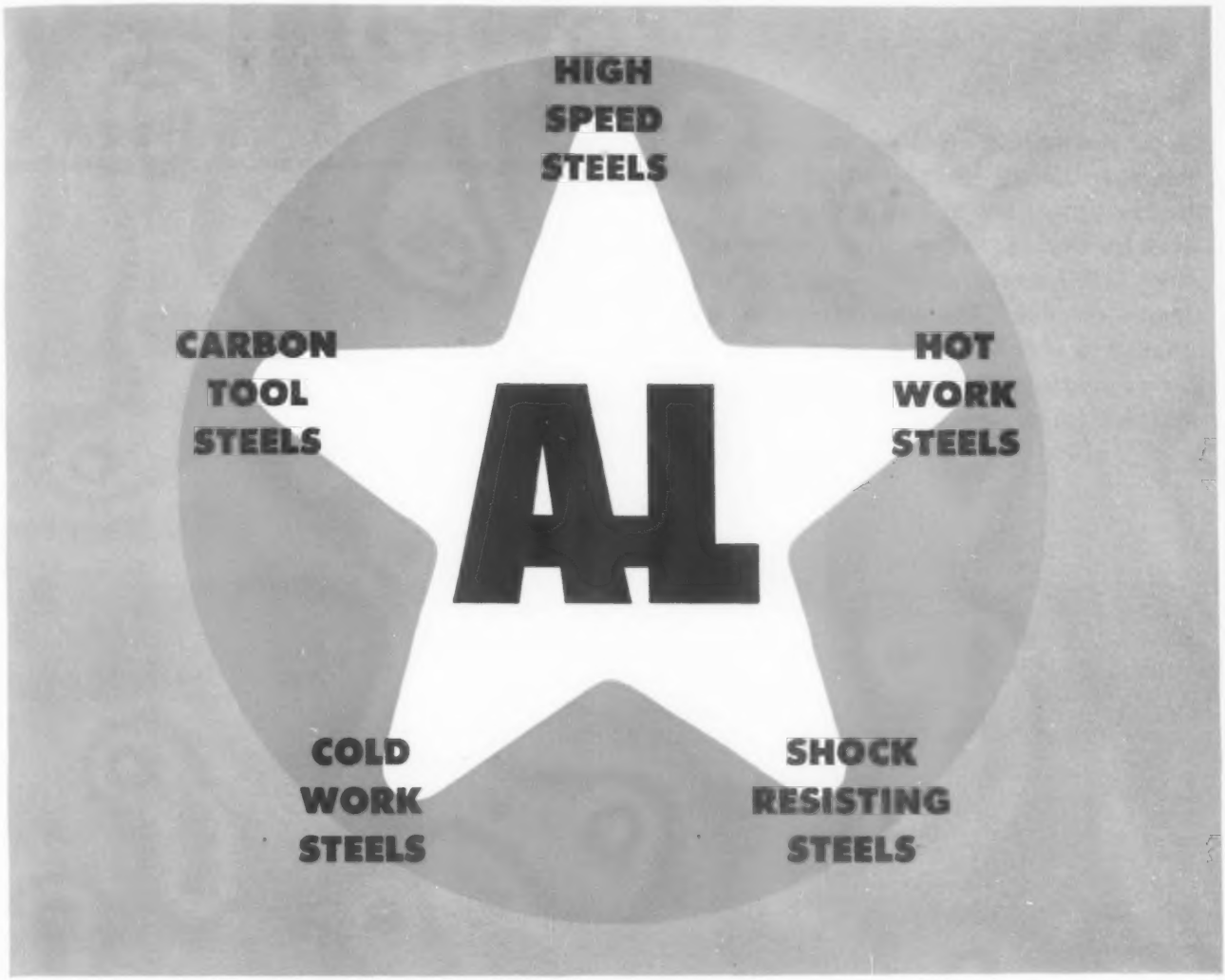

THE *Right* TOOL STEEL FOR YOUR *Individual* REQUIREMENTS

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BOOTH-416

NO more using a tool steel that merely comes close to your actual requirements.

Now you can select the steel that fits each of your needs *exactly*—gives you better, faster performance or longer tool life. There's sharp emphasis on cost-reduction today—and in the broadly varied line of Allegheny Ludlum Tool and Die Steels you'll find a type to fit each one of your machine operations like a hand in a glove—the *right* tool steel that can save money for you. ● It doesn't cost a thing to let our Service Engineers check your tooling set-ups with you—why not call us in?

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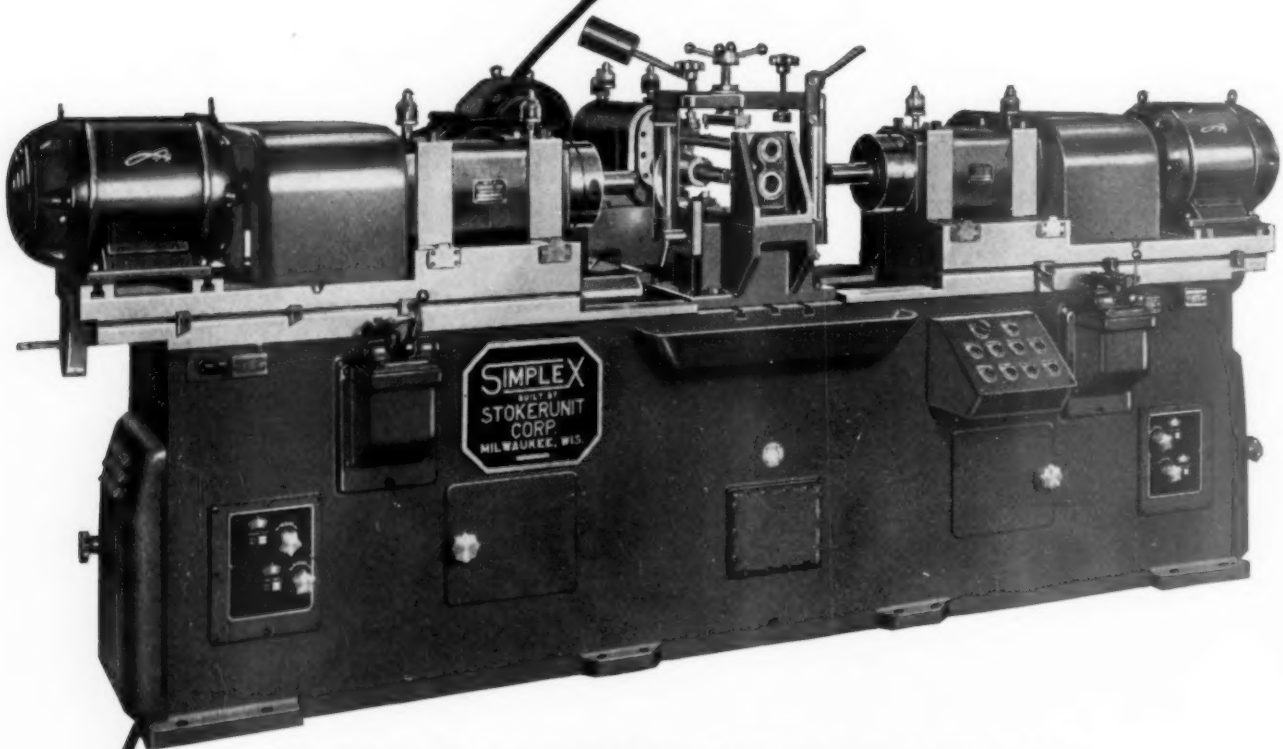

The machine shown is a SIMPLEX 2U 3-way Precision Boring Machine equipped with quick-clamping fixture for loading an opposed cylinder block and crank case while boring two cylinders, the crank shaft hole and the cam shaft hole. This insures accuracy of location and squareness of the important elements of the engine, at the same time providing a high production rate with a saving of labor and space.

Precision Boring Machines

STOKERUNIT CORPORATION

SIMPLEX Machine Tools Division

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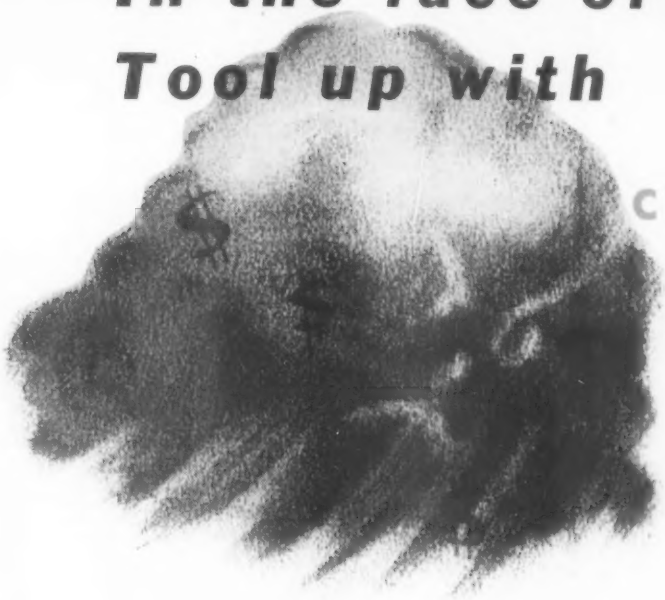
In the face of rising costs
Tool up with TECO
CEMENTED CARBIDE
and
GET MACHINING COSTS DOWN!



MORE PIECES BETWEEN GRINDS

MORE GRINDS PER TOOL

LESS DOWN TIME

LOWER TOOL COST

● Here is one definite step you can take to get more leeway between rising production costs and rigid price ceilings:

Use TECO Cemented Carbide to cut machining costs to new low levels. It holds cutting edges longer. It produces more pieces between grinds. It yields far greater production per tool than any similar material.

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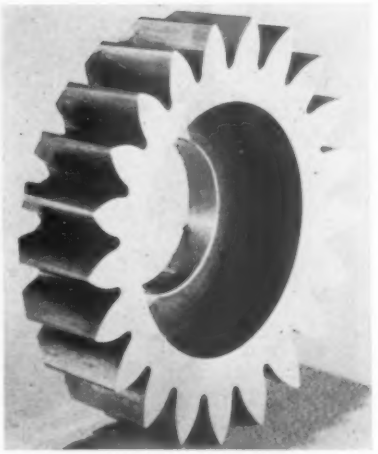

Let National-Cleveland Tools be the step between your blueprints and the products you make . . . These cutting tools have won their international reputation upon highest standards of Accuracy and Durability . . . For example, look into the Warner Gear plant and see a National Cleveland Gear Shaper Cutter at work . . . It's a sure, safe procedure from blueprint to product when the cutting tool bears this well-known mark –

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- ★ Fast travel to all units.
- ★ Spindle and feed units run in bath of oil.
- ★ Column ways are extra wide . . . 5″ x 1½″ and 18″ across. Bed ways are 5″ x 1½″ and 24″ across. Table ways are 4″ x 1½″ and 22″ across.
- ★ Complete oversize construction to insure rigidity, strength and accuracy.
- ★ Extremely long saddle ways to support table.
- ★ 24″ x 36″ table has working surface of its entire area with "T" slots and cross slots.

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Defiance MachineWorks, Inc.,
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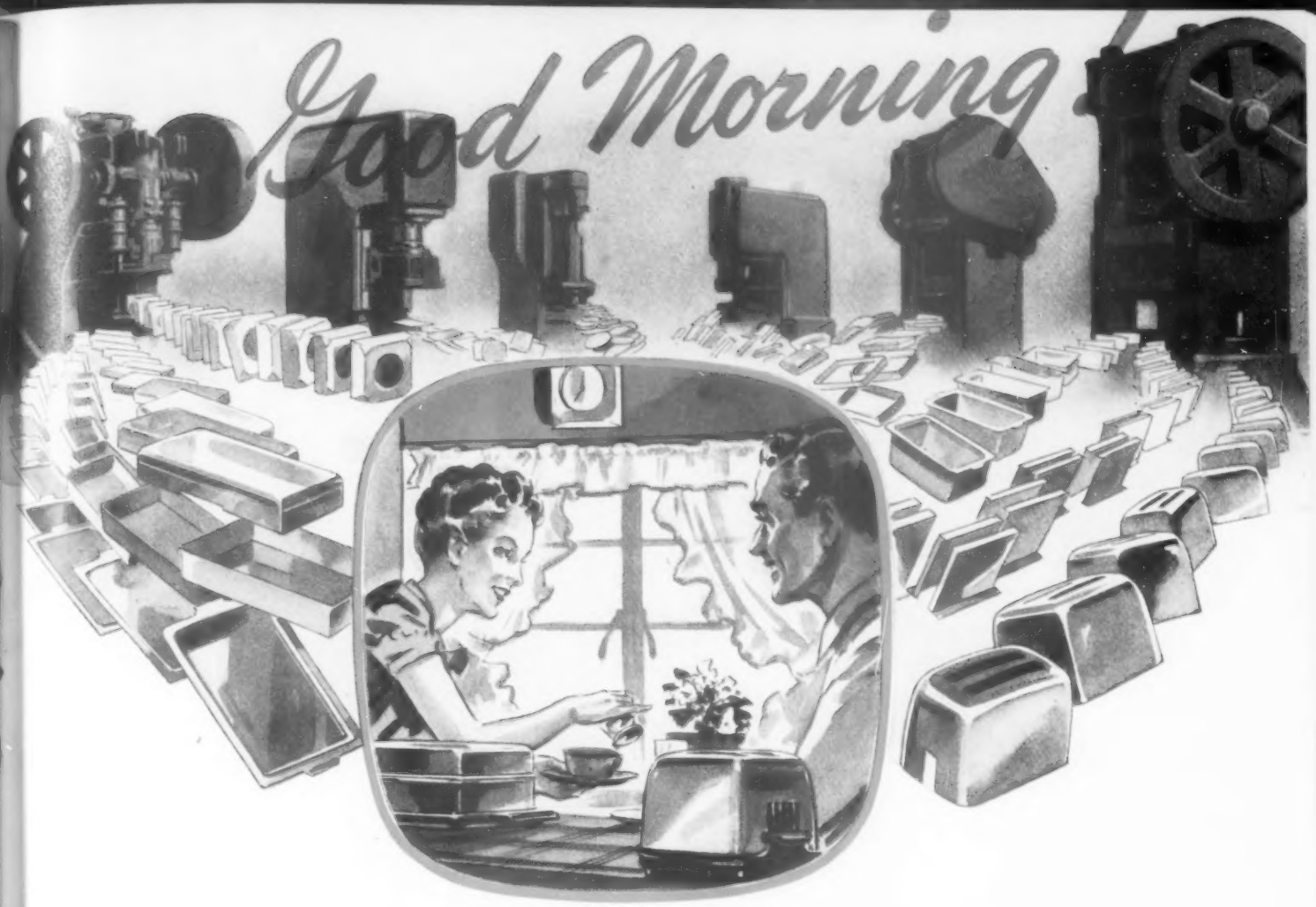

Back of the Bride's Breakfast Table

STANDS PRESS PRODUCTION

Metal stampings produced in modern high speed presses will speed the new electric appliances to the household.

The known dependable accuracy of DANLY PRECISION DIE SETS will speed your civilian production in die making and stampings production for household utilities—or any type of press production.

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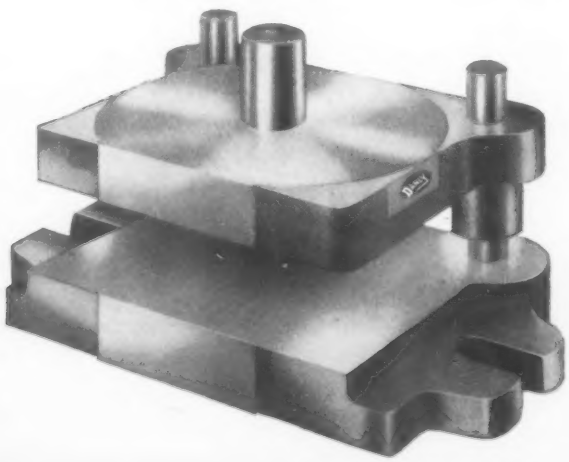

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DANLY DIE SETS

Welded Steel Fabrication

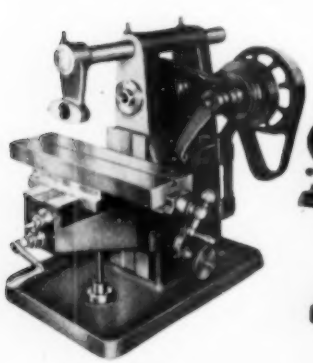
QUICK FACTS on Diamond MILLERS

Simple in operation, low in cost, built to highest standards of quality and precision. Strength and power for heavy operations with all necessary refinements for accuracy and long life. Available in both tool room and production models. Check these Diamond qualifications for your job!

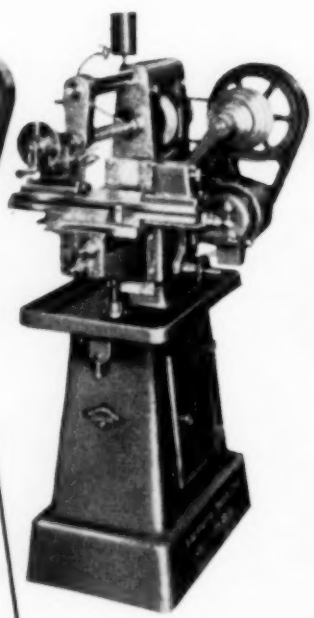
MODEL	TABLE SIZE	LONG. TRAVEL	TRANSVERSE TRAVEL	VERT. TRAVEL	SPINDLE SPEEDS	TYPE DRIVE	POWER FEED	RACK & PINION TABLE FEED	MOTOR	NET WEIGHT
B-12	5⅛" x 20"	12"	6"	9"	6 Speeds 100–1400 rpm	Dual Vee Belt Pulleys	Available as Std. extra	Available	¾ h.p. Recommended	450 lbs.
M-20	5⅛" x 20"	12"	6"	9"	6 Speeds 100–1400 rpm	Dual Vee Belt Pulleys	Included	Available	¾ h.p. Furnished	750 lbs.
M-26	5¾" x 26"	15"	6"	9"	Infinite 75–1200 rpm	Variable Speed	Included	Available	1½ h.p. Furnished	1050 lbs.
M-30	7" x 30"	18"	6"	10"	Infinite 75–1200 rpm	Variable Speed	Included	Available	1½ h.p. Furnished	1300 lbs.

Spindles of all models have noses hardened and ground, with #9 B & S Taper, mounted in Timken Taper Roller Bearings. Built-in coolant systems furnished on Models M-26 and M-30.

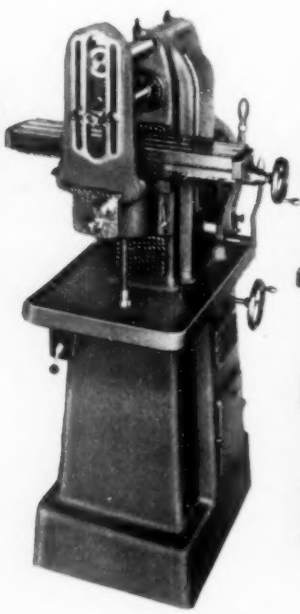
"A MILL FOR EVERY PURSE AND PURPOSE"



Model B-12



Model M-20



Model M-26

Model M-30

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Bulletins available. Address inquiries to Dept. TE today!

Diamond MACHINE TOOL COMPANY

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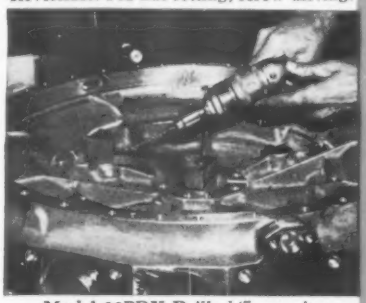
Manufacturers of the DIAMOND Line of Precision Machine Tools and Accessories

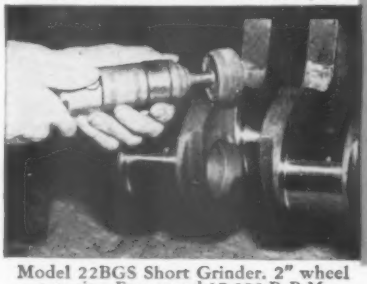
Model 131 Impact Wrench. ¼" to ⅜" capacity Reversible. For nut-setting, screw-driving.



Model 22PDX Drill. ¼" capacity Jacobs chuck. Pistol grip.

Model 22BRX Right Angle Drill. 3,750 R.P.M. ¼" capacity Jacobs chuck.

Model TG High Speed Turbine Grinder. 75,000 R.P.M. For fine finish work. Only 18 oz.



Model 22BGS Short Grinder. 2" wheel capacity. Free speed 17,000 R.P.M.

Big Power FROM SMALL TOOLS

In ARO Pneumatic Tools you get the unbeatable combination of BIG POWER...with small size, light weight and trouble-free performance! Whatever the job—whether drilling, screw-driving, nut-setting, filing, grinding and countless other production operations—ARO does it *faster* and with *less fatigue!* Each tool ARO-engineered for a special use...precision-built for accurate workmanship. Check your tool-needs now with the complete ARO line. Write for catalog. The Aro Equipment Corp., Bryan, Ohio.

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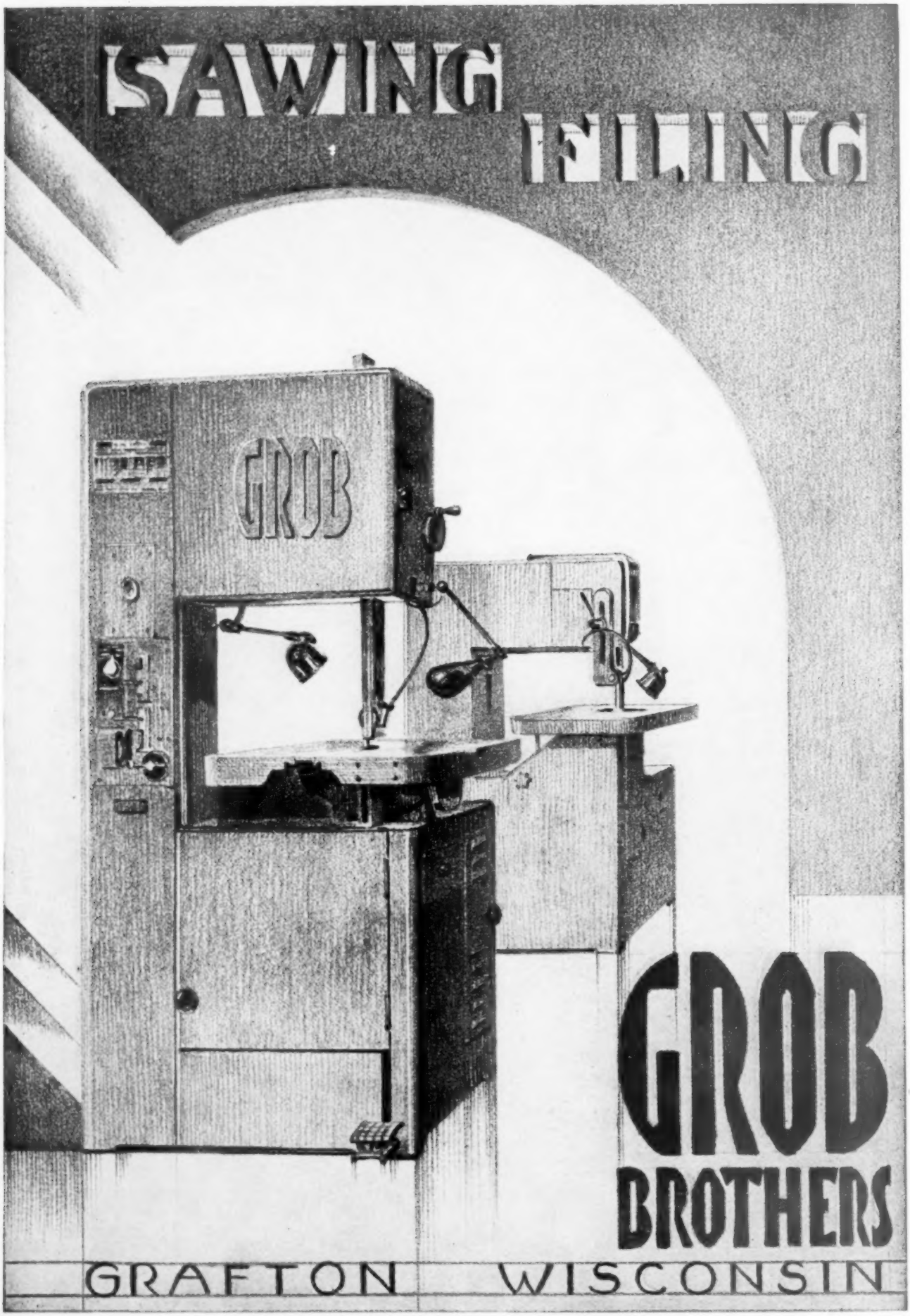
Actual Size

NEW Aro Model 7000 —"cigar size", weighs only 8 oz., 4⅞" long, ¾" diameter. Capacity No. 1 to No. 6 screws. Fully automatic—No manual throttle. Starts automatically when pressure is applied.

THERE'S AN ARO JOBBER NEAR YOU


SAWING
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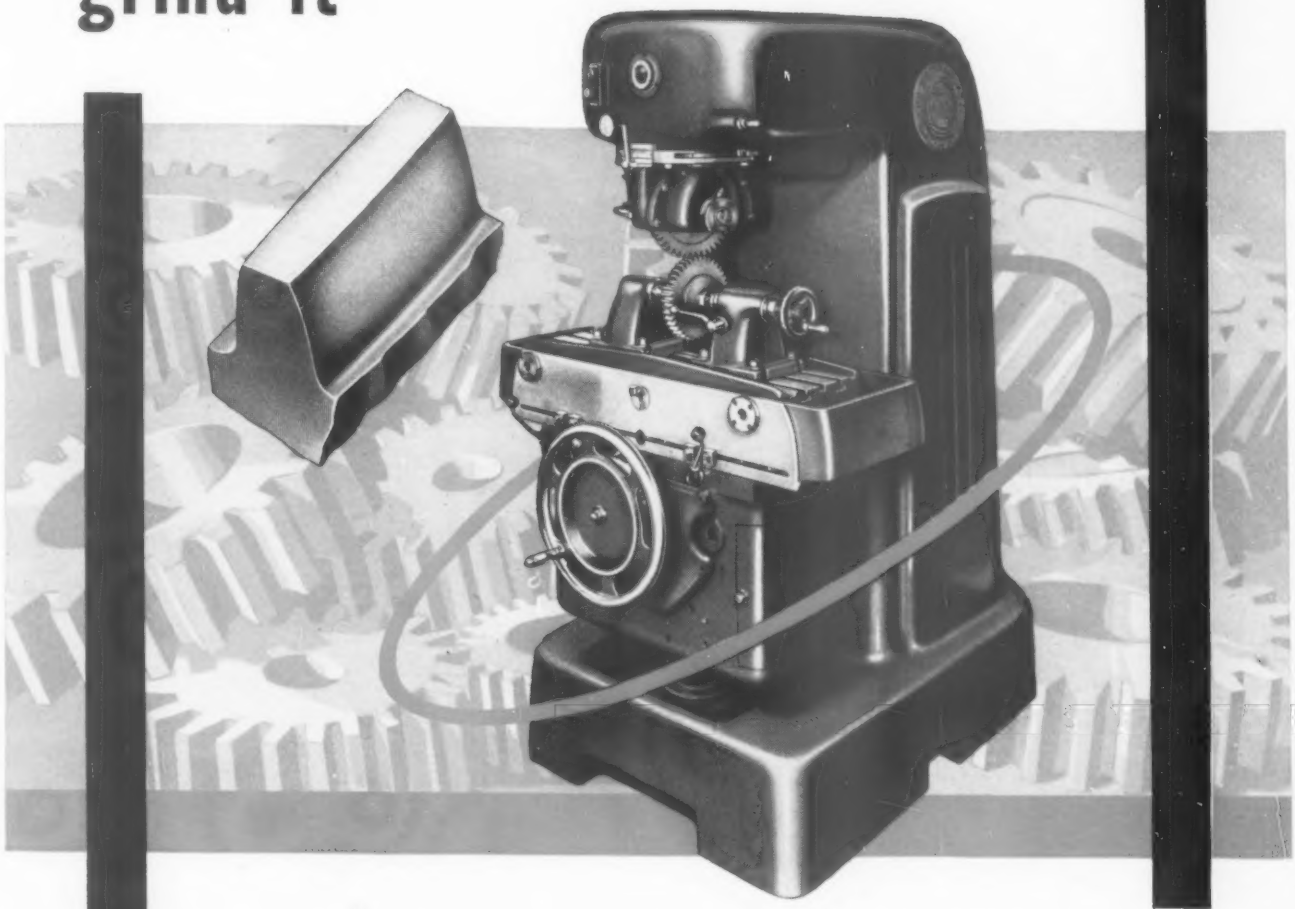
YOU CAN SHAVE A GEAR A LOT FASTER than you can grind it



Gears requiring 40 minutes (floor to floor) for grinding are being shaved in just 5 minutes.

The shaved gears are just as accurate dimensionally as the ground gears; tooth surfaces are just as smooth and of equal if not greater importance, the shaved gear teeth are entirely free of those prevalent hairline grinding cracks which so often result in fatigue failures. Thus by shaving you get better gears faster and at less production cost.

Gears are shaved on Red Ring Rotary Shaving Machines which produce smooth tooth surfaces and correct errors of helical angle, profile and eccentricity. Gears from 3/16" to 220" P. D. can be shaved. Those from 3/8" to 36" P. D. can also be crowned to avoid the danger of failure due to "End Bearing."

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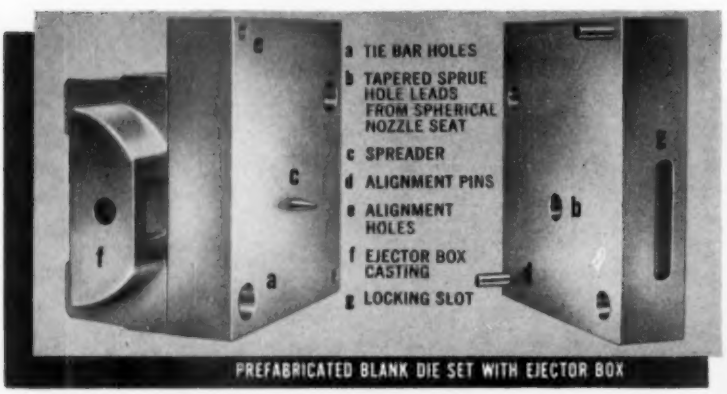
ORIGINATORS OF ROTARY SHAVING AND ELLIPTOID TOOTH FORMS

DIE CASTING comes into your machine shop!

SAVE MONEY NOW ON SMALL RUNS WITH THIS HIGH SPEED, LOW COST MACHINE


a TIE BAR HOLES
b TAPERED SPRUE HOLE LEADS FROM SPHERICAL NOZZLE SEAT
c SPREADER
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f EJECTOR BOX CASTING
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STANDARDIZED PREFABRICATED DIE SETS MEAN QUICK INEXPENSIVE DIES

Here's a die casting machine so simple, so inexpensive, that it is fast becoming a standard machine tool. With the DCMT Die Casting Machine you can make high speed production runs or small quantities of die castings in your own machine shop.

low equipment cost: *Your Machine Tool Dealer handles the DCMT machines which cost no more than a bandsaw, small engine lathe or similar tool room equipment.*

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small runs economical: *Runs as low as 250 die cast parts can be produced economically on the DCMT machine.*

simple operation: *Extreme simplicity of design and construction makes for easy operation and maintenance even by unskilled personnel. Dies can be changed in 2 to 3 minutes.*

close tolerances: *Exact duplication of parts is assured while a general tolerance of ±.002" is easily maintained.*

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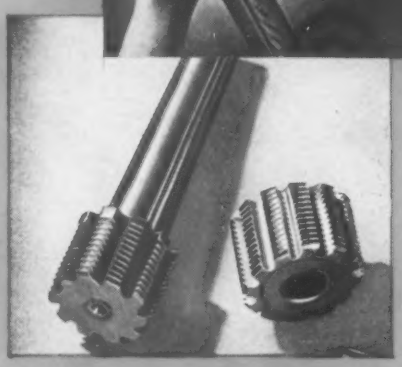
New York 13, N. Y.

Do it with DALZEN

Left: Dalzen taps, in U. S., Metric, Whitworth, and Special forms are precision ground of hardened high speed steel in a complete size range. TUNGSTEN CARBIDE TAPS — EITHER SOLID OR INSERT—A SPECIALTY.



Left: High speed ground thread milling cutters, scientifically heat treated for longer cutting life.

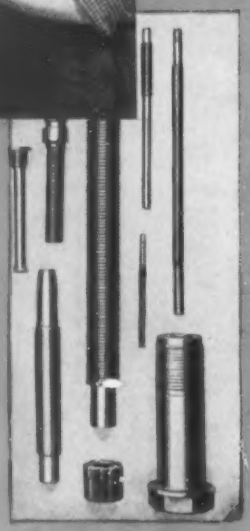
Dalzen manufactures an extensive line of precision cutting tools, parts, thread grinding and special machines — engineered for maximum efficiency and economical operation. Each is the result of years of experience on the part of designers and craftsmen. These are reasons why, all over the United States and in many foreign countries, master mechanics who have used and worked with Dalzen-made machines and tools say, "You can do it better with Dalzen." Write for details on how Dalzen can "do it better" for you.

Below: Dalzen "2-in-1" combines a dependable, accurate center lapping machine with a sturdy drill press. Saves on equipment costs, floor space.

Below: No. 5 *Electronic* Thread Grinder. Easy to operate. High production efficiency and accuracy by controlled wheel speed, motor driven dresser, automatic compensation and other features.

Right: No. 2 Thread Grinder. Compact, upright design saves floor space. Simple to operate. Low first and maintenance cost. Ideal for short or production runs.

Right: Threaded parts are ground to close tolerances exactly to your specifications. Rigid inspection standards assure a uniform fine finish. Jobs requiring rolled or cut threads are also handled.



DALZEN

TOOL AND MANUFACTURING CO.

12255 EAST EIGHT MILE ROAD • DETROIT 5, MICH.

READY TO FABRICATE SURPLUS aluminum

AT 15% TO 45% LESS
(FOB Location)

GOVERNMENT-OWNED STOCK

Here—in production quantities—is the aluminum you need at fixed prices, 15% to 45% off current mill prices, depending on the particular alloy. Much of this special value stock, originally ordered for war plane construction, is still in its original packing. It may be readily fabricated and is available in standard sizes and shapes. Perhaps this material is just what you need to get into full civilian production faster and it costs nothing to find out. Take these three simple steps today:

1. Estimate, for any convenient period, your production needs in each specification, finish, gauge, etc.

2. Then write, wire, or phone that data to your nearest War Assets Corporation office* below. We will advise you of the location of the stock you need, estimate possible delivery dates, quote prices and help arrange credit where indicated.

3. When satisfactory arrangements have been made, we will start shipments.

*NEW SURPLUS STOCK RELEASED DAILY

War Assets Corporation is a Reconstruction Finance Corporation subsidiary in charge of disposing of surplus war materials constantly being released to War Assets Corporation. To reach War Assets Corporation, simply contact your nearest R.F.C. office listed below.

VETERANS OF WORLD WAR II:

To help you in purchasing surplus property from War Assets Corporation, a veterans' unit has been established in each War Assets Corporation Regional Office listed below.

ATTENTION

POWDER METALLURGISTS!

Atomized Aluminum powder —not suitable for paint without further processing—is available in enormous quantities at 10¢ per pound. Can you find a major use for this product? If you can.....!!! Get detailed specifications from your War Assets Corporation office listed below.

TYPES AVAILABLE

A DISPOSAL AGENCY DESIGNATED BY THE SURPLUS PROPERTY ADMINISTRATION for Surplus Producers' and Capital Goods, Aircraft and Plants formerly handled by Reconstruction Finance Corporation . . . and for Surplus Consumer Goods formerly handled by United States Department of Commerce.

WAR ASSETS CORPORATION

(A SUBSIDIARY OF RECONSTRUCTION FINANCE CORPORATION)

RFC OFFICES (INCLUDING FORMER DEPARTMENT OF COMMERCE REGIONAL SURPLUS PROPERTY OFFICES) LOCATED AT: Atlanta • Boston • Chicago • Denver • Kansas City, Mo. • New York • Philadelphia • San Francisco • Seattle • OTHER RFC SURPLUS PROPERTY OFFICES LOCATED AT: Birmingham • Charlotte • Cleveland • Dallas • Detroit • Helena • Houston • Jacksonville • Little Rock • Los Angeles • Louisville • Minneapolis • Nashville • New Orleans • Oklahoma City • Omaha • Portland, Ore. • Richmond • St. Louis • Salt Lake City • San Antonio • Spokane • OTHER FORMER DEPARTMENT OF COMMERCE REGIONAL SURPLUS PROPERTY OFFICES LOCATED AT: Cincinnati and Fort Worth

157-S

THE BIG THREE

★ **THE BIG THREE** amount to a policy which we have maintained throughout 16 years of designing and building tools for industry.

If you are interested in tools that measure up to these standards, we will be glad to receive your inquiry.

QUALITY TOOL & DIE CO.

Manufacturers of "Quality" Products

401-15 NORTH NOBLE STREET, INDIANAPOLIS 2, INDIANA

More than a Good "Soluble Oil"

Stuart's SOLVOL
Water-mixed cutting fluid

. . . Saves Tools, Time and Trouble

An answer to the challenge of many "impossible" wartime machining operations, Stuart's SOLVOL Liquid Cutting Compound is now licking peacetime jobs formerly considered beyond the scope of water-mixed fluids. Essentially a high quality cutting oil dispersed in water, it lubricates and cools both carbide and high speed tools insuring maximum tool life and increased production. For further information write D. A. Stuart Oil Co., Ltd., 2727-49 So. Troy St., Chicago 23, Illinois.

D. A. Stuart Oil Co.
LIMITED
ESTABLISHED 1865
Stocks in Principal Metal Working Centers

for Taper Shank Convenience with Straight Shank Economy-

Glenzer

Small Tool UTILITY DRIVERS

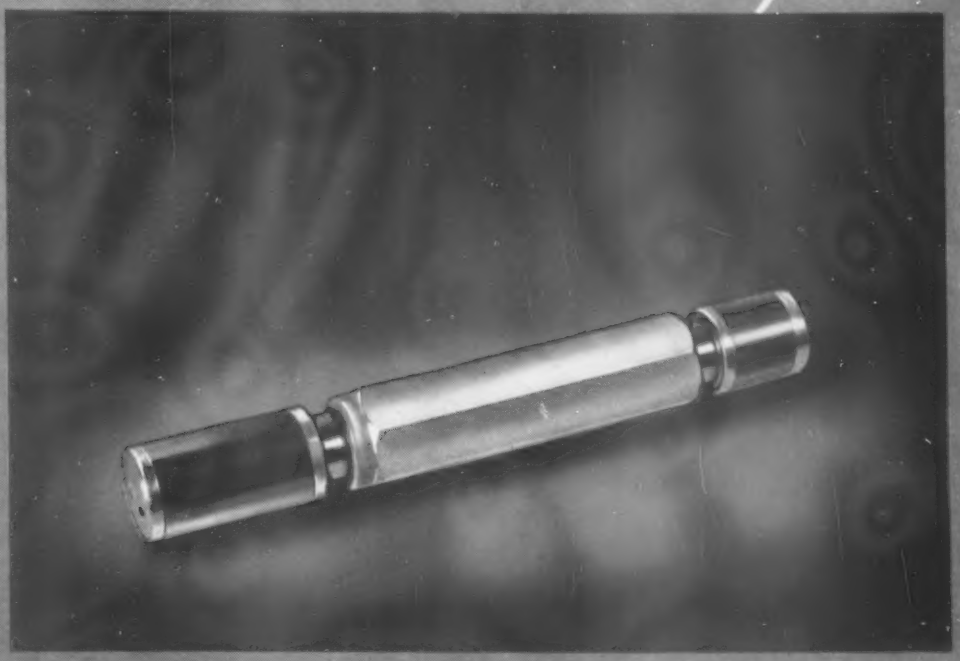
Use them to speed peacetime production. Ford, General Motors, Chrysler, General Electric, International Harvester, Caterpillar Tractor—thousands of large and small manufacturers and tool shops have been driving drills and other small tools with these sleeves since World War I — for years they've been specified standard.

Complete line for all sizes and tapers, including the new Republic Shankless Drills.

This removeable taper shank reduces small tool costs 40% and more, by actual customer records.

THE J. C. GLENZER CO., Inc.
6467 EPWORTH BLVD. DETROIT 10, MICH.

WITH STEEL GAGES-GAGE LIFE WAS 24 HOURS *Yesterday*



Today—

GAGE LIFE IS *8 months* WITH
NORBIDE GAGES

This NORBIDE Plug Gage gave eight months' service where previously one steel gage was worn out every day. The gage was used on a grinding job on an internal grinder where the work was checked on the machine. The NORBIDE gage replaced at least 160 steel gages and, therefore, enabled the plant to save about $1200 over the eight months' period.

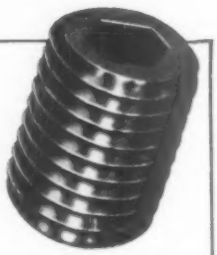
Because Norton Boron Carbide is the hardest material made for commercial use, NORBIDE gages outwear conventional types of measuring devices 150 times and more. In addition to their great wear resistance NORBIDE gages will not pick up lint nor become charged with particles of metal and they are inert to chemicals employed where gages are used.

Ask your regular supplier about NORBIDE gages or for additional information write to:

NORTON COMPANY • **Worcester 6, Mass.**

NORBIDE-The Hardest Material Made by Man
REGISTERED TRADE-MARK

When you're in a TIGHT spot...specify *Mac-its*

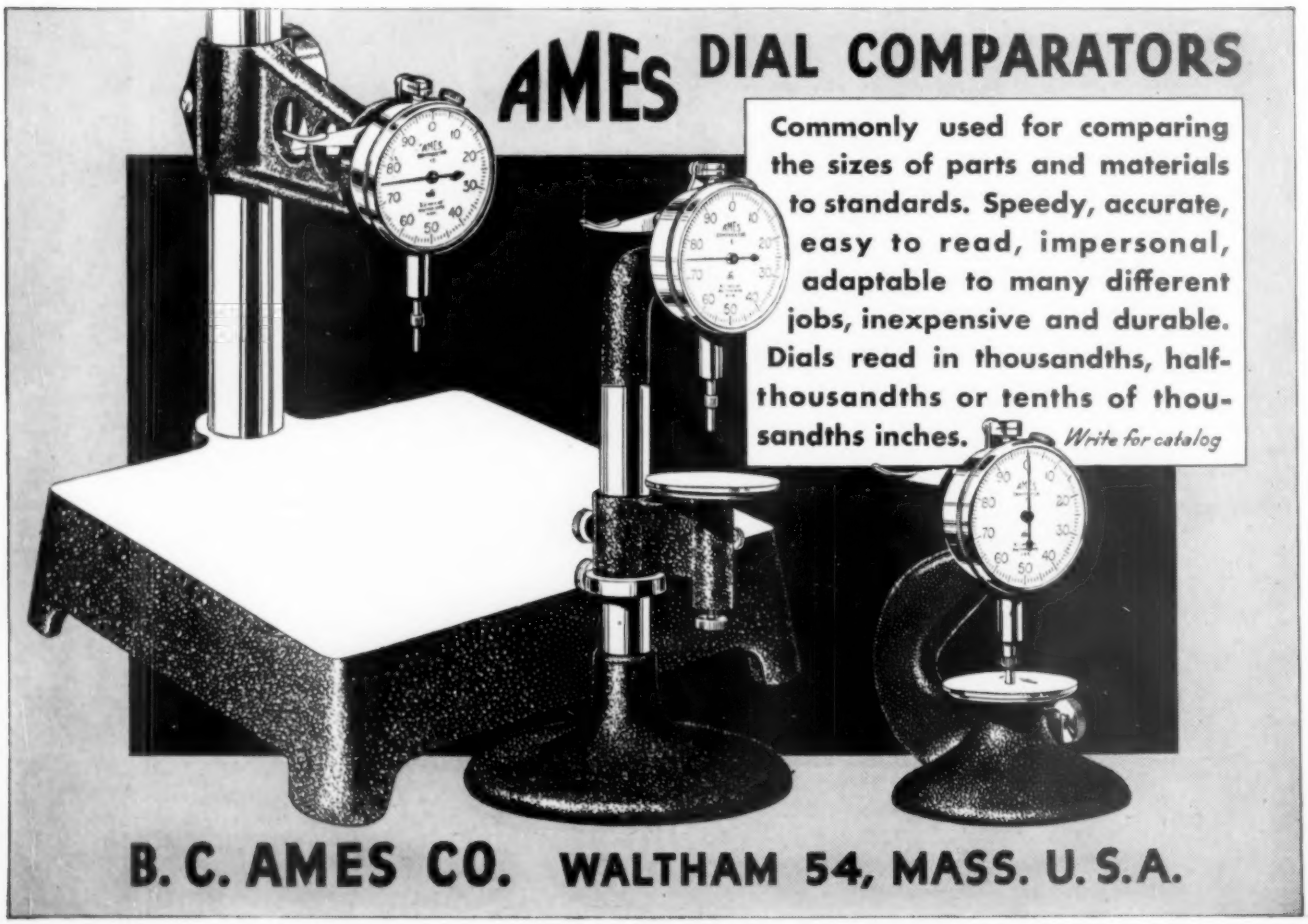


Mac-it alloy steel hollow set screws are milled from the solid bar, with die-cut threads. Hex sockets are generated by a special process insuring full-depth accuracy. Heat-treated for maximum strength and to prevent rounding out or splitting of the socket or upsetting of the point.

Mac-it products include Socket Head Cap Screws, Hollow Set Screws, Hexagon Head Cap Screws, Square Head Set Screws, Stripper Bolts, Hexagon Socket Pipe Plugs. *All are made of alloy steel and heat-treated.*

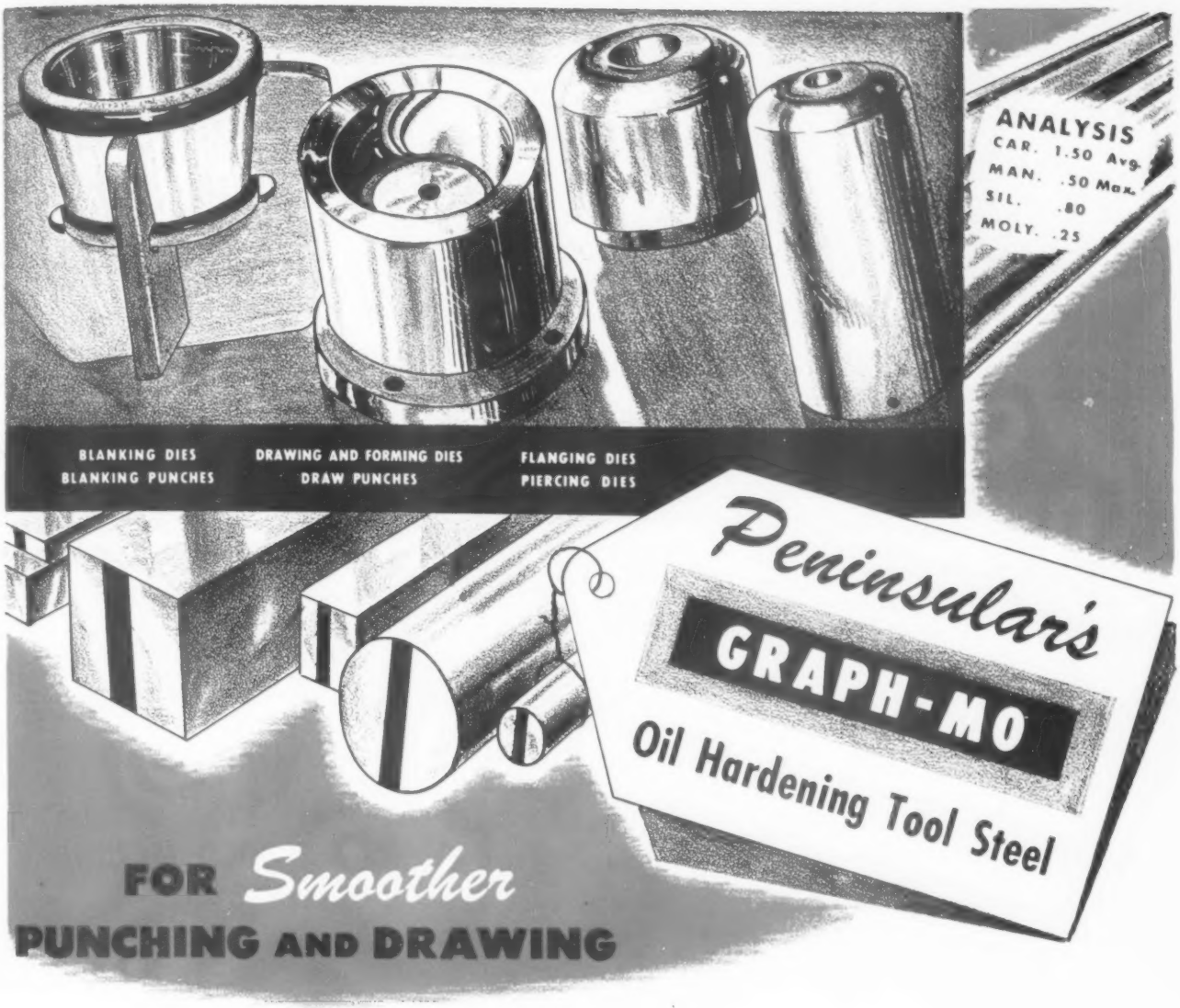
STRONG, CARLISLE & HAMMOND CO. • *Cleveland 13, O.*

AMEs DIAL COMPARATORS



Commonly used for comparing the sizes of parts and materials to standards. Speedy, accurate, easy to read, impersonal, adaptable to many different jobs, inexpensive and durable. Dials read in thousandths, half-thousandths or tenths of thousandths inches. *Write for catalog*

B. C. AMES CO. WALTHAM 54, MASS. U.S.A.



Graph-Mo is an oil hardening tool steel with non-deforming characteristics. It contains about fifty per cent free graphite after annealing to give you remarkable machineability at no extra cost. The graphite retains the lubricant—and there's the important superiority of Graph-Mo over ordinary tool steels when used for dies that require particular non-seizing properties.

The Peninsular catalog contains detailed information on Graph-Mo and our complete line of high grade tool steels. Phone or write for your copy.

The PENINSULAR STEEL Co.

CHerry 7173 2222 Lakeside Avenue, Cleveland 14 Emergency Phone—LAkewood 1133

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ERIE: Industrial Metals & Products Co., 934 W. 9th St. ROCKFORD, ILL.: Rockford Industrial Supply Co.

WALKER-TURNER
MACHINE TOOLS
Cut Production Costs
...4 WAYS!

1. LOW FIRST COST:
■ Sound design, volume production and manufacturing know-how keep W-T prices low.

2. LOW OPERATING COST:
■ Compact, rugged construction, elimination of unessential weight, keep power and maintenance costs low.

3. WIDE SPEED RANGES:
■ Selection of correct cutting speed for each material provides maximum cutting efficiency.

4. MUTI-PURPOSE DESIGN:
■ Adaptable to a wide variety of operations — in standard or special set-ups in single or multiple installations—solving troublesome tooling problems at low cost.

W-T RADIAL CUT-OFF MACHINE

● Cuts all materials. Ram glides 21¾" on 8 ball bearings. Operates at all angles.

W-T RADIAL DRILL

● Speed range 110-8300 R.P.M. Head tilts 45° either way.

WALKER-TURNER COMPANY, Inc.
PLAINFIELD, N. J.

walker-Turner — **MACHINE TOOLS**
DRILL PRESSES • HAND AND POWER FEED • RADIAL DRILLS
METAL CUTTING BAND SAWS • POLISHING LATHES • FLEXIBLE SHAFT MACHINES
RADIAL CUT-OFF MACHINES FOR METAL • MOTORS • BELT & DISC SURFACERS

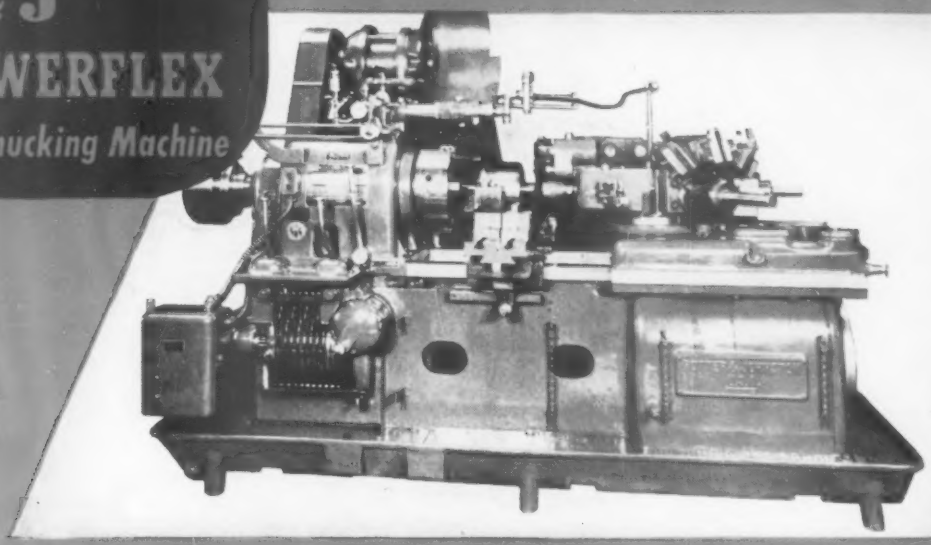
The Ancients Knew the Value of **GOOD MARKING**

History records our ancestors' appreciation of the value of individual marking to establish the authenticity of all personal and business transactions. The mark of a signet ring impressed in sealing wax was usually employed for protection of their good name against fraudulent use on letters and papers.

Trade Marks have been used by business houses for similar purposes for many years. To the consumer they are a recognized guarantee of the quality of the product and the integrity of the maker. For nearly a century Jas. H. Matthews & Co. has specialized in the design and manufacture of marking devices. If you have a marking problem, we will be glad to help find a solution. *Any product worth marking is worth marking well.*

JAS. H. MATTHEWS & CO.
3923 FORBES STREET — PITTSBURGH 13, PA.
BRANCH — PLANTS
NEW YORK, BOSTON, CHICAGO, — PHILADELPHIA, NEWARK, SYRACUSE
District Sales Offices: Cleveland, Cincinnati, Birmingham

The **P & J**
5 D POWERFLEX
Automatic Chucking Machine

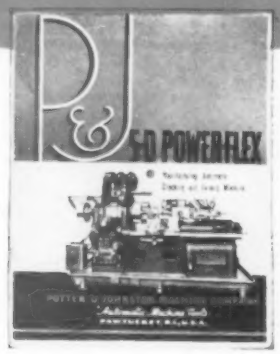


...to help you reduce maintenance and increase production on chucking work.....

The 5D Powerflex is an important P&J contribution to lower production costs. Its many modern features are the result of long, specialized experience in the design and building of automatic chucking machines. The net result is a machine which has the rigidity necessary for handling heavy cuts and that ease of control which makes the operator's job easy and untiring.

Specifically, the 5D POWERFLEX offers: a headstock fully equipped with Timken Tapered Roller Bearings; spiral gearing and shafts running in an oil bath; large turret in taper seat automatically clamped after indexing; hardened and ground steel ways; power operated speed and feed change mechanism controlled by automatic levers. These and many other features, described in illustrated bulletin are responsible for the high production and low maintenance which have characterized the Type D Powerflex on a wide range of work in shops the nation over.

It will be to your advantage to investigate.



Send for literature describing the 5-D Powerflex.

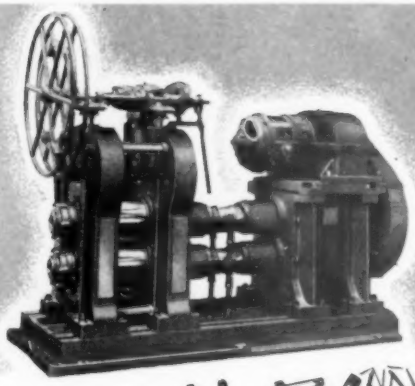
CONDENSED SPECIFICATIONS

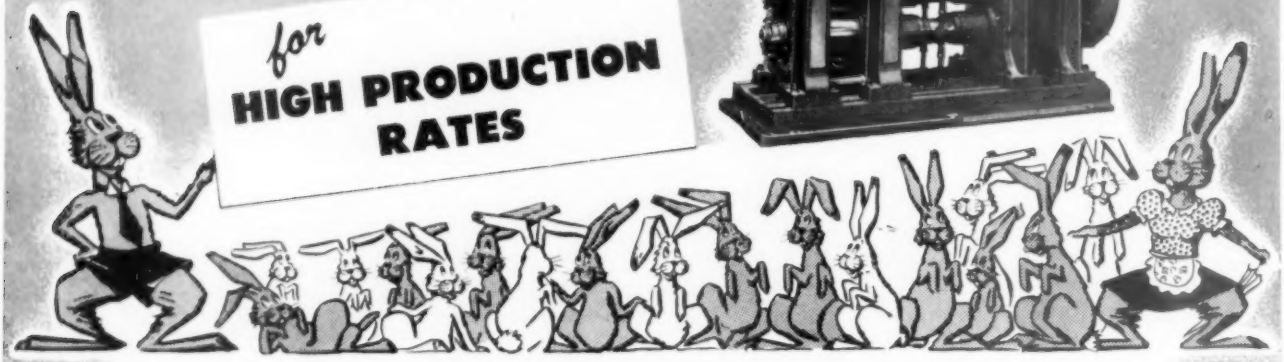
Swing over Bed	25"
Swing over Cross Slide	12"
Travel of Cross Slide—each way	5"
Number of Turret Faces . . . 5 Standard, 4 and 6 Special	
Diameter of Hole in Turret	2½"
Depth of Hole in Turret	5"
Total Turret Slide Travel	13"
Turret Feed	8"
Turret Travel to start of Index	12¾"
Diameter of Hole through Spindle	2⅝"

Buy those EXTRA Victory Bonds to give that EXTRA punch.

POTTER & JOHNSTON MACHINE COMPANY
Pawtucket, Rhode Island

"Standard"
ROLLING MILLS
for HIGH PRODUCTION RATES





"Standard" Rolling Mills assure high production hot or cold rolling of your strip, rod or ingot. Speeds are provided for rolling metals in any range from 10 feet to 500 feet per minute, depending upon your needs. Two, Three, or Four High Mills are available with roll sizes from 1½" diameter and 1" face to 16½" diameter and 18" face.

"Standard" manufactures special units for grading, cross and pinch rolling, forming wire to exact dimensions, and for a large variety of shaping operations.

CATALOG SECTION RM AND DETAILED RECOMMENDATIONS WILL BE SENT UPON REQUEST.

STANDARD MACHINERY COMPANY
1585 ELMWOOD AVE., PROVIDENCE 7, R. I.

Quality Equipment for Production
On TODAY'S Tool Engineering

Abart
SPEED REDUCERS AND GEARS

Over 75 types and sizes of Abart Reducers, spur, worm, and combinations, 1/50 to 400 h.p. Compactly built, dust-proof, and oil-tight. Ask for complete catalog with full engineering data, and drawings.

Abart Gears are precision cut of any gear material, in any quantity. Spur, Bevel, Worms, Helical, Internal, Worm Wheels, Spiral, Sprockets, Racks, etc. No stocks are carried. Send B/P or specifications.

You are cordially invited to bring your Reducer or Gear problems to Abart for immediate attention. Wire or write

Abart GEAR and MACHINE CO., 4810 WEST 16TH ST. CHICAGO 50, ILLINOIS

TALIDE-*tipped* Blades Outwear Others 25 to 1

Talide Blades for centerless grinding have many natural advantages over cast iron, tool steel, and hard faced blades.

Tungsten Carbide has the greatest compressive strength of any known material. Talide Blades wear and wear. You can buy Talide Centerless Blades with the Talide Metal insert of any length in one solid piece. There are no sections or seams to scratch or mar the work. Scoring and galling cause no trouble.

This extra long service life gives you extremely high continuous production rates. Rejects practically disappear from your work sheet.

In precision grinding, all types of products...roller bearings, fountain pens, cap screws, twist drills, bushings, shafts, spindles, screw machine parts, Talide Blades always outperform other blades at least 25 to 1.

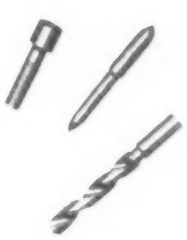
Metal Carbides Corporation, a pioneer in Tungsten Carbide, will assist you in designing super-hard Talide Blades for your work. Apply this 25 to 1 advantage to your production and watch those costs go down.

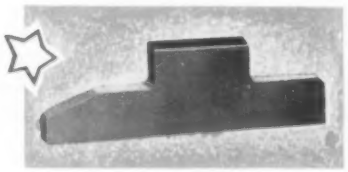
Send for Talide Blade catalog 43-W P, complete with prices, sizes, and specifications.

Standard Blades carried in stock

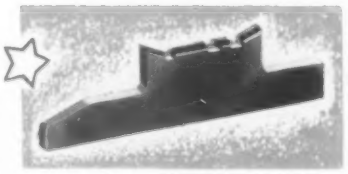
TALIDE METAL MEETS EVERY REQUIREMENT

Talide (TUNGSTEN CARBIDE) Performance!

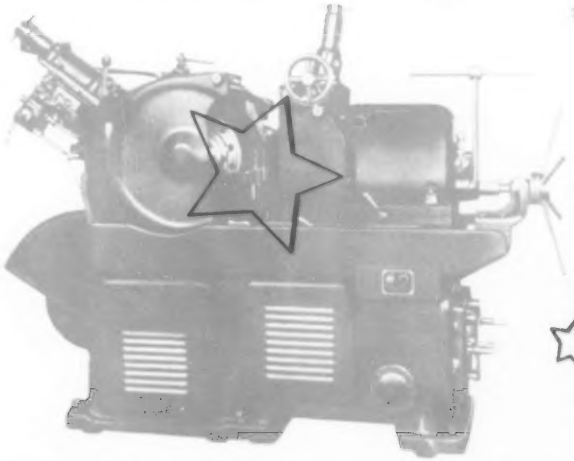


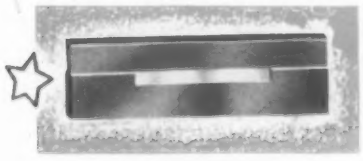


· IN-FEED ·



· FORM ·





· THRU-FEED ·

Metal Carbides is the only company which can make Tungsten Carbide wear strips in one solid piece of any length

THE ENGINEERED CARBIDE FOR ALL APPLICATIONS

METAL CARBIDES CORPORATION

YOUNGSTOWN 5, OHIO *Pioneers in Tungsten Carbide Metallurgy*

SINTERED CARBIDES FOR CUTTING • HOT PRESSED CARBIDES FOR DRAWING AND WEAR RESISTANCE

EDWARD Blake COMPANY

634 COMMONWEALTH AVE., NEWTON CENTRE 59, MASS.

You ARE interested in getting maximum life and accuracy from your taps... the **BLAKE TAP GRINDER,** *will get it*

See this machine and the complete line of Blake equipment at the ASTE Show in Cleveland April 8-12.

No machine is better than the cutting edge of the tool it uses.

Please send me Bulletin 544 which gives complete details on Blake Tap Grinders. T-E.

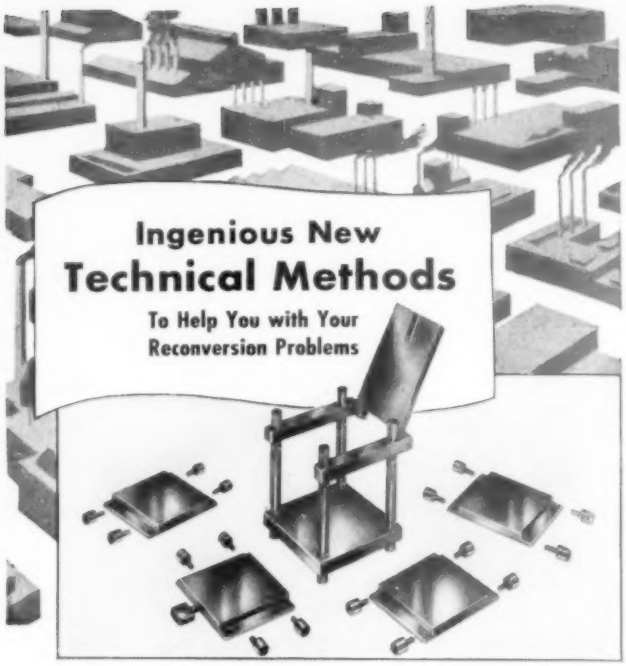
NAME_____ TITLE_____

COMPANY_____

STREET_____

CITY_____ STATE_____

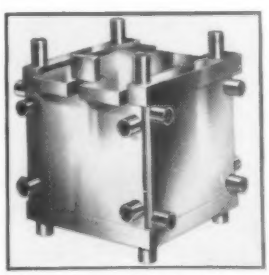
BLAKE TAP GRINDERS—FILTAIRE PORTABLE DUST COLLECTORS—AMERICAN TOOL HOLDERS—BLACK DIAMOND PRECISION DRILL GRINDERS—WALTHAM CUTTER SHARPENERS—HAGER CARBIDE TOOL GRINDERS



Drillet Box Jig Saves Up to 75% of Jig Body Expense and Labor!

The six-sided Drillet Box Jig above and at right has a range of 125 different sizes, making it possible to accommodate all sizes up to 6" capacity—for drilling, reaming, counter boring, counter sinking, spot facing, tapping, etc.

The Drillet Box Jig makes special tool design for drill jig unnecessary. Saves up to 75% of the time and cost of building a jig body. By merely turning thumbscrews and raising leaf, parts may be quickly loaded or unloaded. The jig may be used on all six sides, taking advantage of its full capacity.



Drillet Box Jig in Locked Position

Another useful product is chewing gum. You can enjoy chewing Wrigley's Spearmint Gum even while your hands are busy. The pleasant chewing helps to steady you—helps keep you alert and on your toes when you're doing a monotonous job.

Besides the satisfaction chewing gives you, it helps keep your mouth moist and fresh so you naturally feel better—and feeling better you work better.

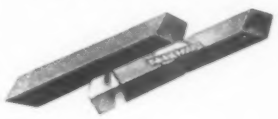
Scores of industrial plants report that they have stepped up their workers' morale and efficiency by making chewing gum available to them.

You can get complete information from The Chicago Drillet Corporation 920 S. Michigan Ave., Chicago 5, Ill.

AA-60

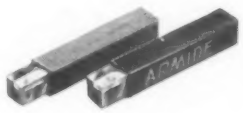
ARMSTRONG
CUTTER SERVICE

Whatever the cutting speed you need, no matter what the material to be machined, the ARMSTRONG System of Tool Holders provides correctly designed ARMSTRONG TOOL HOLDERS and cutters of proper type for the job.



For ordinary machining at the speeds indicated, we recommend:

up to **150 f.p.m.**
ARMSTRONG HIGH SPEED Bits, Blades or Cutters in standard ARMSTRONG TOOL HOLDERS.



up to **300 f.p.m.**
ARMALLOY (cast alloy) Bits and Blades in ARMSTRONG *CA* TOOL HOLDERS.

up to **600 f.p.m.**
ARMIDE (Carbide-Tipped) Cutters in ARMSTRONG *Carbide* TOOL HOLDERS.

ARMSTRONG BROS. TOOL CO.
"The Tool Holder People"
370 N. FRANCISCO AVE. • CHICAGO 12, U.S.A.
Eastern Warehouse and Sales Office
199 Lafayette St. • New York, N. Y.
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1275 Mission St. • San Francisco, Calif.

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are cordially invited to inspect the exhibit of

Johansson

GAGE BLOCKS
and JO-BLOCK ACCESSORIES
(Space 234)

Cleveland Auditorium
during the annual meeting of the
A. S. T. E.
April 8 to 12 inclusive

Ford

FORD MOTOR COMPANY
JOHANSSON DIVISION
Dearborn, Mich.

At the
A. S. T. E. NEW ERA EXPOSITION SEE
THESE **LATEST DEVELOPMENTS**
by **Anker-Holth**
IN AIR AND HYDRAULIC DEVICES

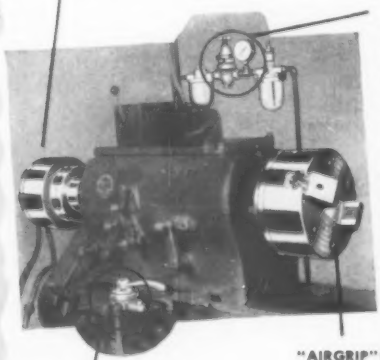
You are cordially invited to visit us at the Show in Cleveland, from April 8-12 Public Auditorium, Booth 604

DUAL-ACTION NON-ROTATING CYLINDERS
Wherever there is need for controlled pull—push—lift or lowering action you get fast, smooth, dependable power that does the job right. *Extra* strong cylinder walls (⅛" thick)—no tie rods. Makes servicing easy—either end of cylinder quickly removable.

Anker-Holth also offers a complete line of *Hydraulic Cylinders*—non-rotating and rotating.

AIRGRIP

AIR OR HYDRAULIC ROTATING CYLINDERS. The inlet connection has double ball-bearing construction which is patented. Permit speeds formerly impossible. Can run for years without attention. No manual adjustments.



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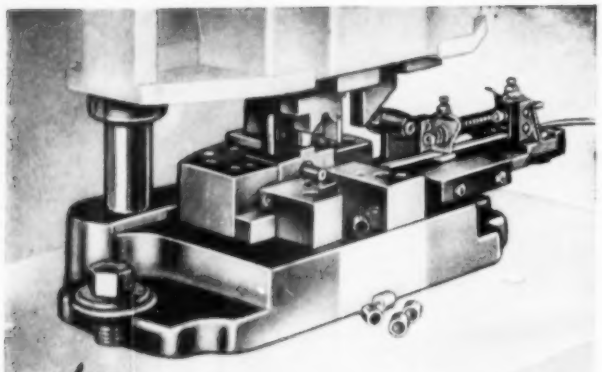

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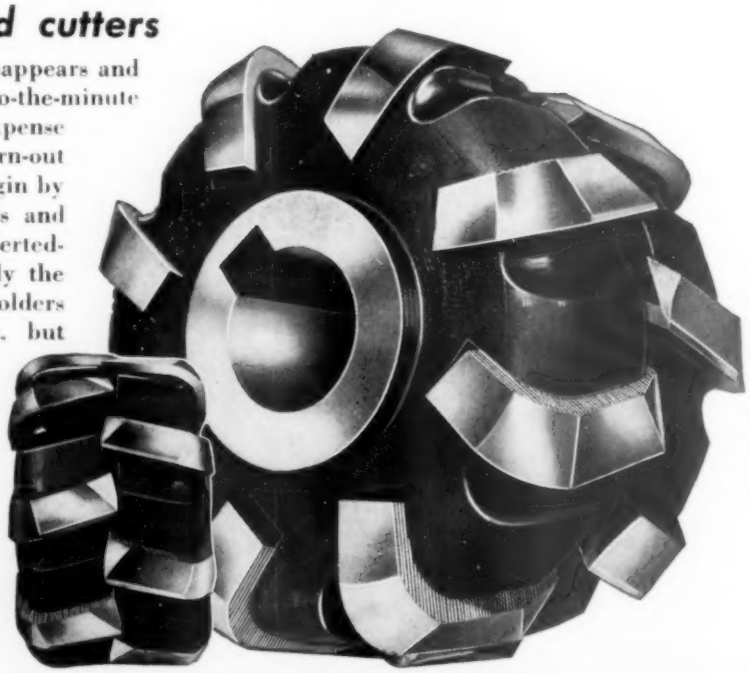

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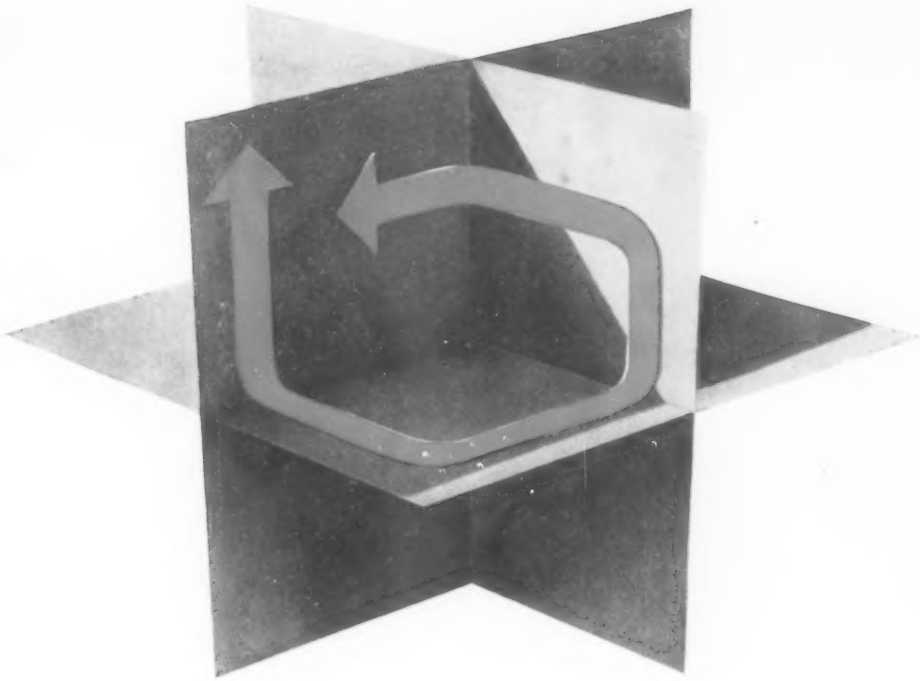

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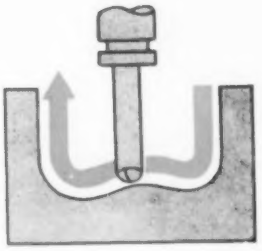
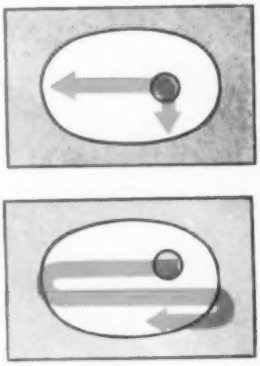
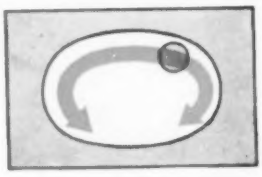


WITH INDEXING



Profiling



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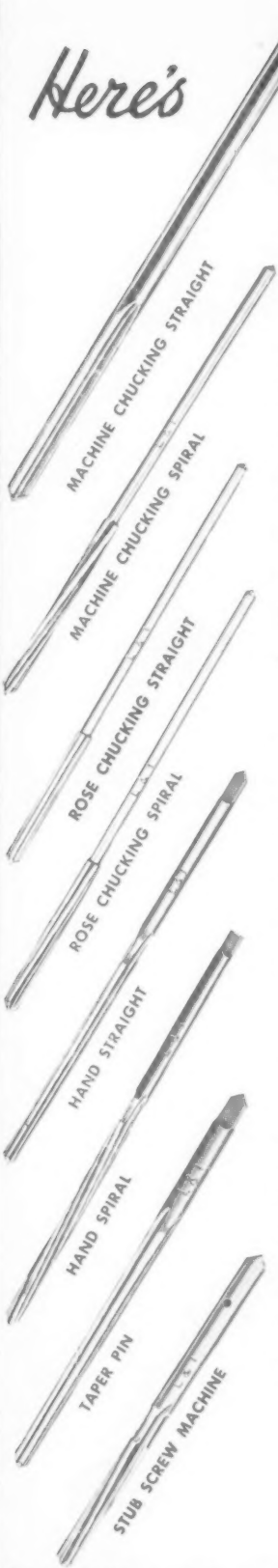

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These Tapping Tips aren't designed to carry engineering advice on tapping problems. They're really friendly hints, picked up by Woody from the boys in the shops he calls on, and passed on for whatever good they'll do. If they make some job run a little easier or quicker or maybe cut costs or save some headaches, we'll feel they're worthwhile.

The individual technical problem that comes up so frequently should have a definite engineering recommendation. If you will send us complete data —material, type of hole, diameter and depth, lubricant, etc., our engineers will be glad to offer specific suggestions.

NOTE: Woody Spencer's Tapping Tips will appear here as often as Woody gets time to write them up. Look for them.

Woody Spencer's Handy Tap Guide is full of helpful information on tapping. It's all arranged in convenient indexed form for quick, easy use. It's FREE. Write for your copy on the company letterhead.

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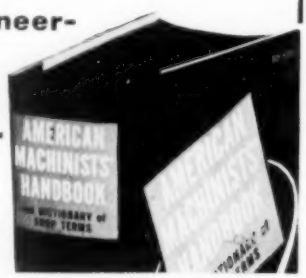

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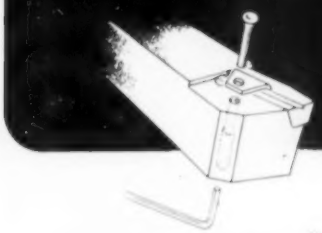

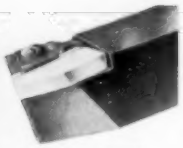

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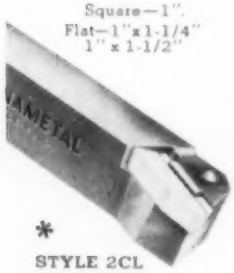

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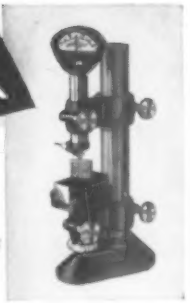

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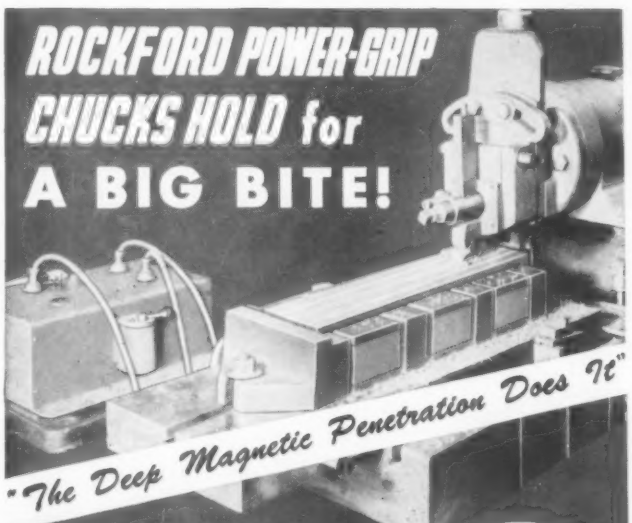

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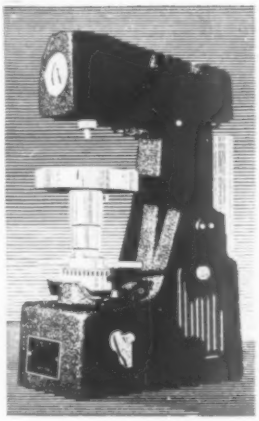

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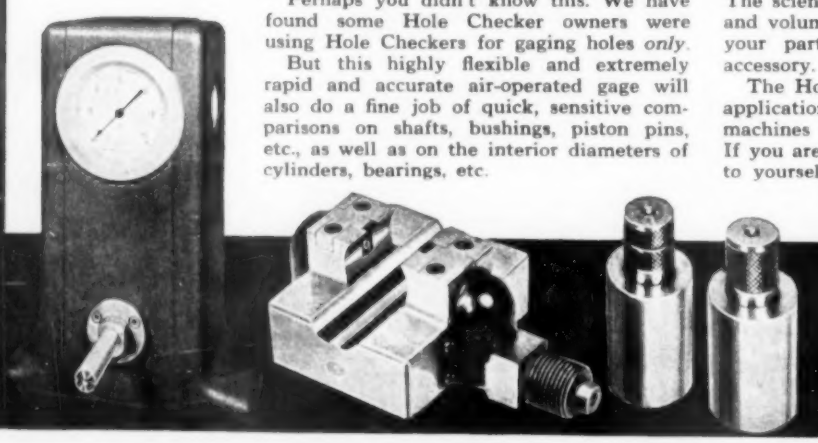

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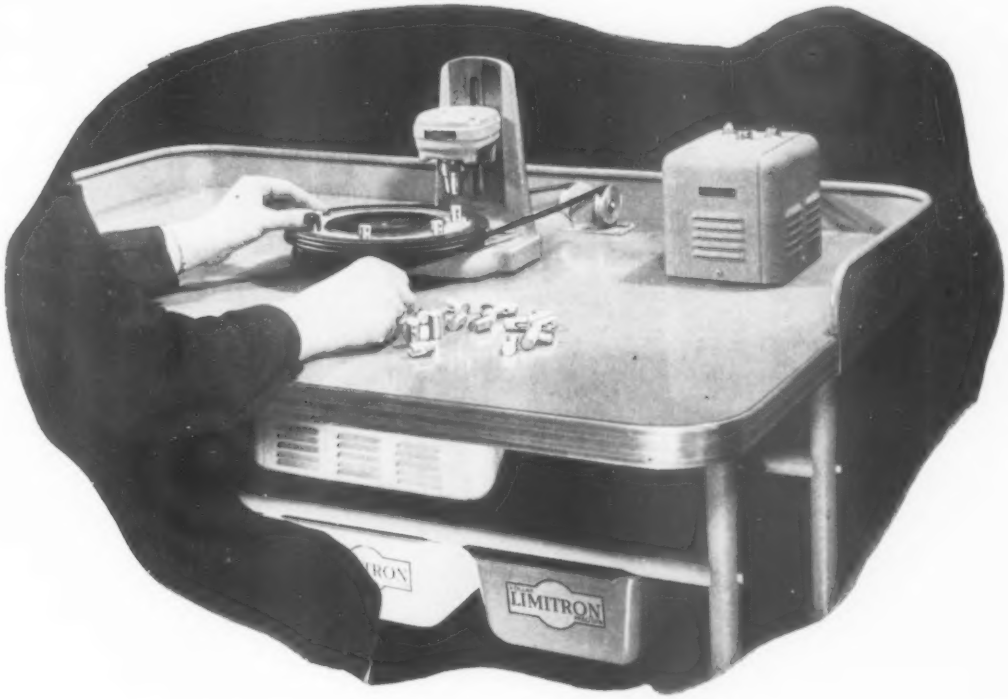

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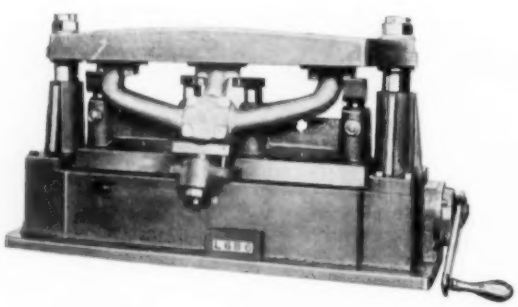

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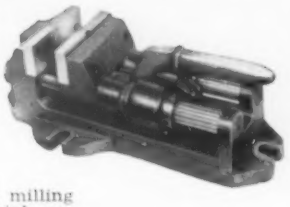

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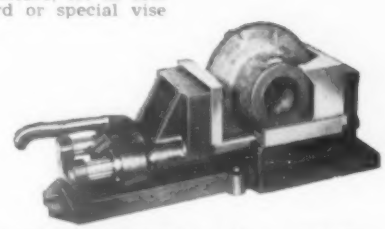

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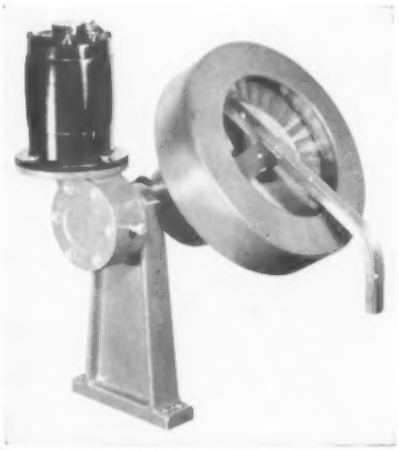

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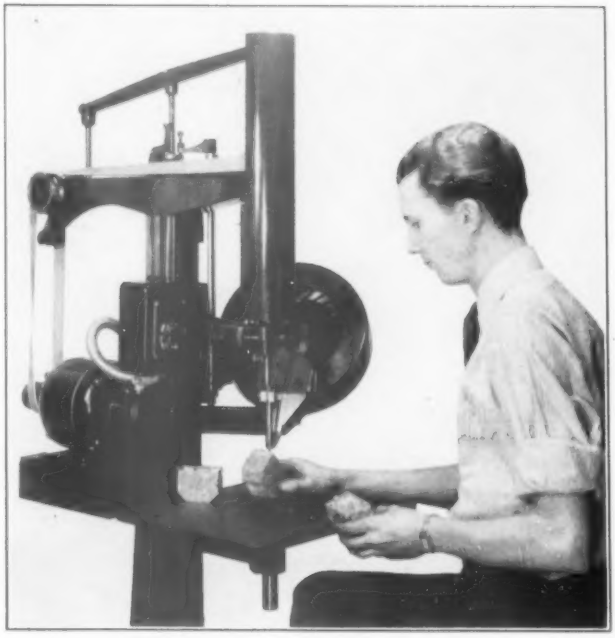

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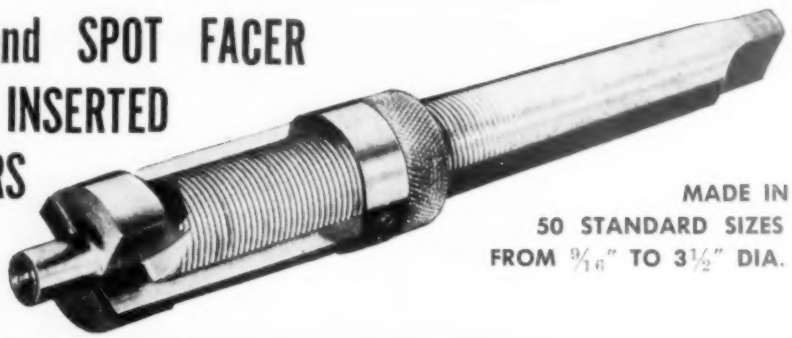

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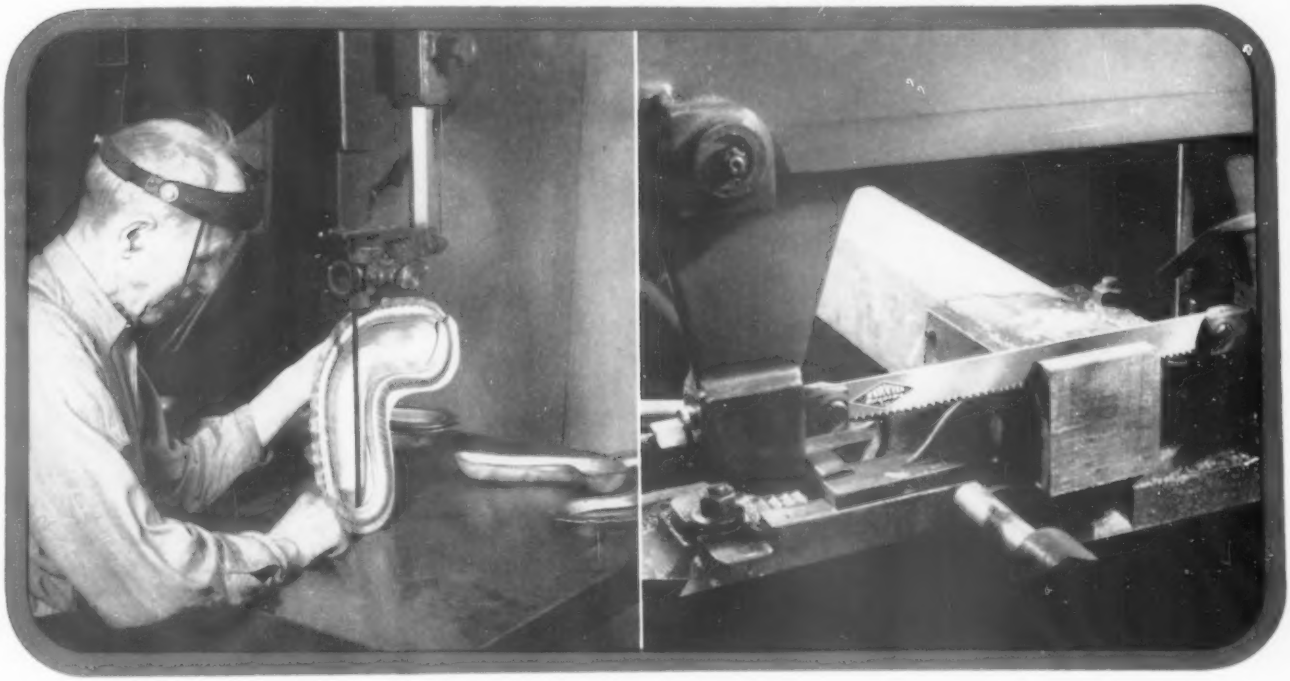

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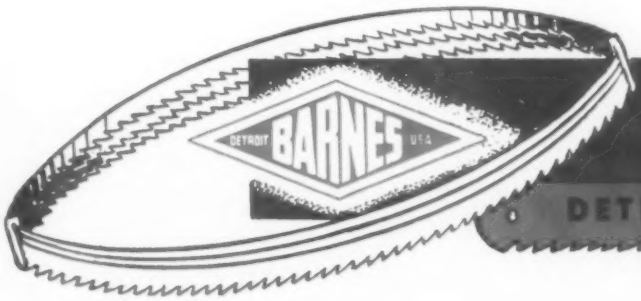

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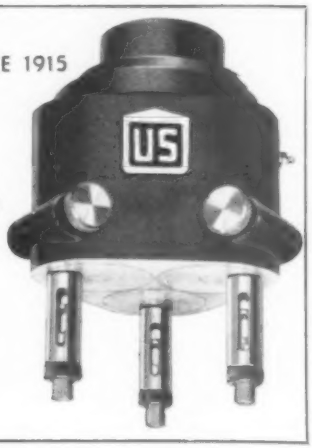

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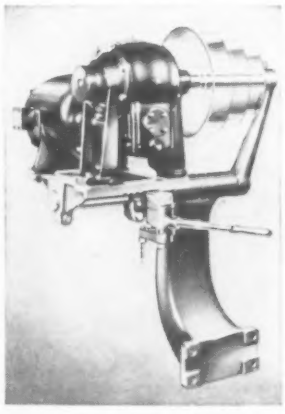

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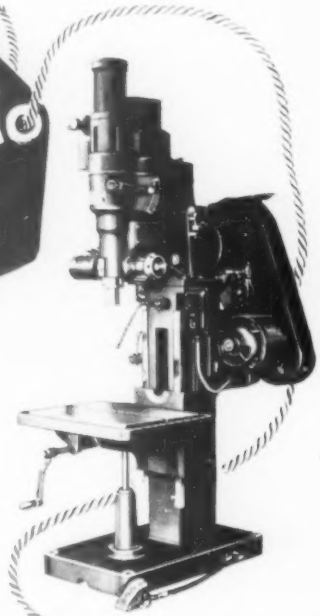

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- Cut-off Tools
- Flat Form Tools
- Dovetail Form Tools

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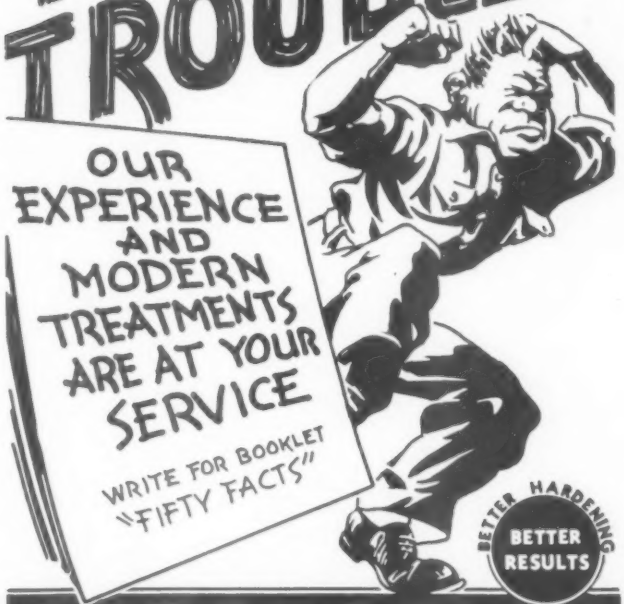
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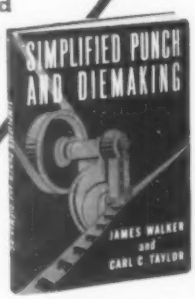

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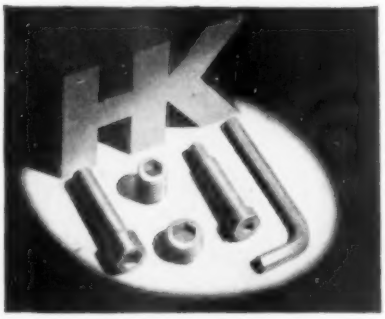

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October 1, 1945

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Dayton 1, Ohio

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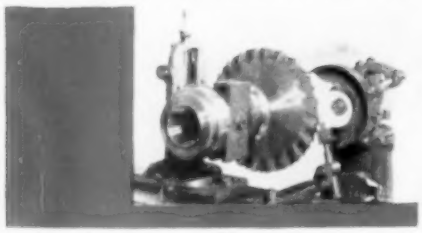

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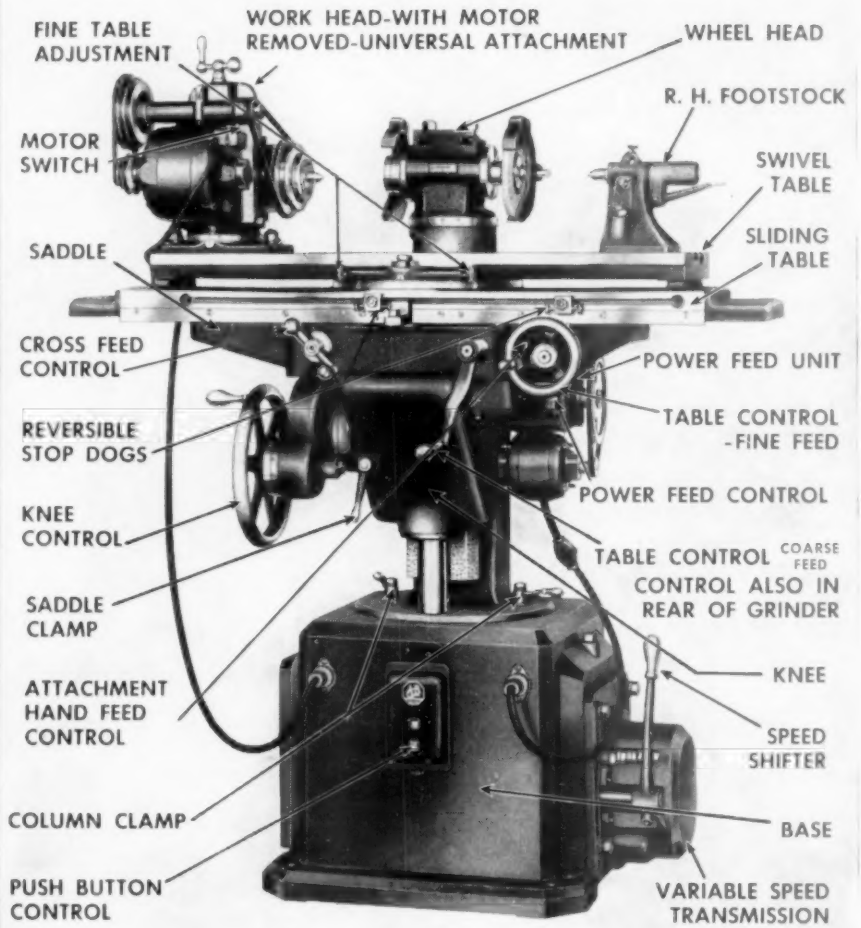

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